UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802- 4213

JAN 6 2006

In response refer to:
151422SWR2003SA8897:MET

Mr. Gene K. Fong
Division Administrator
Federal Highway Administration
650 Capitol Mall, Suite 4-100
Sacramento California 95814-4706

Dear Mr. Fong:

This document transmits NOAA's National Marine Fisheries Service's (NMFS) biological and conference opinions based on our review of the proposed Airport Road Bridge Replacement project located near the City of Anderson, Shasta County, California, and its effects on endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run Chinook salmon (*O. tshawytscha*), threatened Central Valley steelhead (*O. mykiss*), and their respective designated critical habitats. In addition, this document analyzes the potential project-related effects on proposed threatened southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.). Your March 4, 2005, request for formal consultation was received on March 9, 2005. Your March 4, 2005, letter also requested initiation of formal conferencing on proposed critical habitat for Central Valley spring-run Chinook salmon and Central Valley steelhead. A subsequent request for formal conferencing on green sturgeon dated June 7, 2005, was received on June 10, 2005.

A final rule designating critical habitat for Central Valley spring-run Chinook salmon and Central Valley steelhead was published on September 2, 2005 (70 FR 52488). The rule becomes effective on January 2, 2006. Therefore, the analysis of effects on the recently designated critical habitat for spring-run Chinook salmon and steelhead is included in the biological opinion instead of the conference opinion.

These biological and conference opinions are based on information provided in the March 9, 2005, biological assessment for the proposed project; the June 7, 2005, addendum for green sturgeon; several meetings and telephone conversations between NMFS staff and representatives from the California Department of Transportation (Caltrans), Shasta County, and ENPLAN (the environmental consultant for this project); field investigations; and other sources of information. A complete administrative record of this consultation and conference is on file at the NMFS Sacramento Area Office.

Based on the best available scientific and commercial information, these biological and conference opinions conclude that this project is not likely to jeopardize the continued existence of the above listed and proposed species, or adversely modify designated critical habitat. Because NMFS believes there is the likelihood of incidental take of listed species as a result of the proposed project, an incidental take statement is attached to the biological opinion. This incidental take statement includes reasonable and prudent measures that NMFS believes are necessary and appropriate to reduce, minimize, and monitor project impacts. Terms and conditions to implement the reasonable and prudent measures are presented in the take statement and must be adhered to in order for take incidental to this project to be exempted from the section 9 take prohibitions. The reasonable and prudent measures designed to minimize take of listed salmonids also are expected to minimize take of the proposed threatened southern DPS of North American green sturgeon. Therefore, there are no measures specific to green sturgeon and all reasonable and prudent measures and terms and conditions are required to be implemented upon issuance of these opinions.

Also enclosed are Essential Fish Habitat (EFH) conservation recommendations for Pacific salmon as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended (16 U.S.C. 1801 *et seq.*; Enclosure 2). This document concludes that the Airport Road Bridge Replacement project will adversely affect the EFH of Pacific salmon in the action area and adopts the ESA reasonable and prudent measures and associated terms and conditions from the biological opinion as the EFH conservation recommendations.

Section 305(b)4(B) of the MSA requires the Federal Highway Administration (FHWA) to provide NMFS with a detailed written response within 30 days, and 10 days in advance of any action, to the EFH conservation recommendations, including a description of measures adopted by FHWA for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR 600.920[j]). In the case of a response that is inconsistent with our recommendations, FHWA must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

We appreciate your continued cooperation in the conservation of listed species and their habitat, and look forward to working with you and your staff in the future. If you have any questions regarding this document, please contact Mr. Michael Tucker in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Mr. Tucker may be reached by telephone at (916) 930-3604 or by Fax at (916) 930-3629.

Sincerely,

Rodney R. McInnis

Rodney R. McInnis
Regional Administrator

cc: NMFS-PRD, Long Beach, CA

Enclosure 1

BIOLOGICAL AND CONFERENCE OPINION

AGENCY: Federal Highway Administration

ACTIVITY: Airport Road Bridge Replacement Project

CONSULTATION CONDUCTED BY: Southwest Region, National Marine Fisheries Service

DATE ISSUED: JAN 6 2006

I. CONSULTATION HISTORY

NOAA's National Marine Fisheries Service (NMFS) received a draft biological assessment and a draft Essential Fish Habitat evaluation on March 19, 2003, and provided a letter of comment to the project's environmental consultant (ENPLAN) dated April 29, 2003.

Several telephone discussions were held between Cindy Luzietti of ENPLAN and Michael Tucker of NMFS in October 2004 concerning timeframes for instream work and other potential impact avoidance and minimization measures.

On March 9, 2005, NMFS received the final biological assessment (BA) and request for initiation of formal consultation from the Federal Highway Administration (FHWA). This letter also requested initiation of formal conferencing on proposed critical habitat for Central Valley spring-run Chinook salmon and Central Valley steelhead.

A final rule designating critical habitat for spring-run Chinook salmon and steelhead was published on September 2, 2005 (70 FR 52488). The rule will become effective on January 2, 2006. Therefore, the analysis of effects on the recently designated critical habitat for spring-run Chinook salmon and steelhead was included in the biological opinion instead of the conference opinion.

On June 7, 2005, FHWA provided NMFS with an addendum to the final BA which addressed potential project impacts on the southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*). The green sturgeon had recently been proposed for listing as threatened under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), and FHWA requested that formal conferencing be conducted to assess the potential project impacts to green sturgeon, in conjunction with the ongoing formal consultation.

II. DESCRIPTION OF THE PROPOSED ACTION

A. Project Activities

The proposed action is to replace the Airport Road-North Street Bridge (Airport Road Bridge) over the Sacramento River, north of the City of Anderson at 122° 17' 38" West; 40° 28' 21" North, in Shasta County, California (Figure 1). The existing 1285-foot-long, 28-foot-wide two-lane bridge will be replaced with a 1430-foot-long, 69-foot-wide four-lane bridge. The two-lane approaches on North Street and Airport Road will be widened to four lanes between Riverside Avenue and Dersch Road. The project corridor is approximately 4800 feet in length and varies from about 100 to 400 feet in width. Most of the biological field surveys extended at least 100 feet beyond these boundaries. The project area boundary, shown in Figure 2, includes the probable construction staging areas.

The new four-lane concrete box girder bridge will be constructed immediately upstream of the existing bridge. The new bridge will have four 260-foot interior spans and two 195-foot end spans. Five vertical bents will support the bridge, two of which will be located in the river. Each bent is expected to consist of four circular columns resting on a pile cap, which will be about 15 feet below grade. Each column will be approximately five feet in diameter. There will be approximately 60 steel H-piles for each bent, which will need to be driven to support the structure. Construction will begin in June 2006 and require approximately 1.5 years to complete. Removal of the existing bridge will take place following completion of the new bridge.

Work would begin with construction of the overbank portions of the new bridge including the abutments. Two clean gravel work pads would be placed in the river channel, one extending from the north shore and one from the south. The north shore pad would extend approximately 185 feet into the channel at a width of about 90 feet (16,650 square feet); the south shore pad would extend approximately 130 feet into the channel at a width of 80 feet (10,400 square feet). The river channel in this location is about 550 feet wide; therefore, with work pads of this size and configuration, at least 200 feet would remain open in the middle of the river channel for fish passage. The gravel work pads would provide stable access to the new bent locations, as well as reduce the need for temporary piles/pile driving by eliminating the need for a work trestle during demolition. The work pads would also serve as approaches for the temporary work trestle erected for bridge construction purposes.

Cofferdam placement would begin after gravel placement, but no earlier than October 15, followed by excavation of the river bottom inside the cofferdams and driving of piles. It is anticipated that this work can be done in 2 to 3 months if the contractor is able to work on both in-river bents simultaneously. The contractor will be able to continue construction of these two bents while building a trestle bridge between the bents. This trestle bridge, which would also be used for falsework to support the new bridge construction, would require driving of temporary piles and could be completed by mid-March. If required, the trestle bridge could be removed through the remainder of spring when the heaviest flows in the river are most likely to occur. The temporary piles would remain in place in this instance. Temporary piles and work pads would be periodically inspected for debris and any accumulated debris would be removed. The bridge superstructure can be completed and open to traffic in about eight months. After the

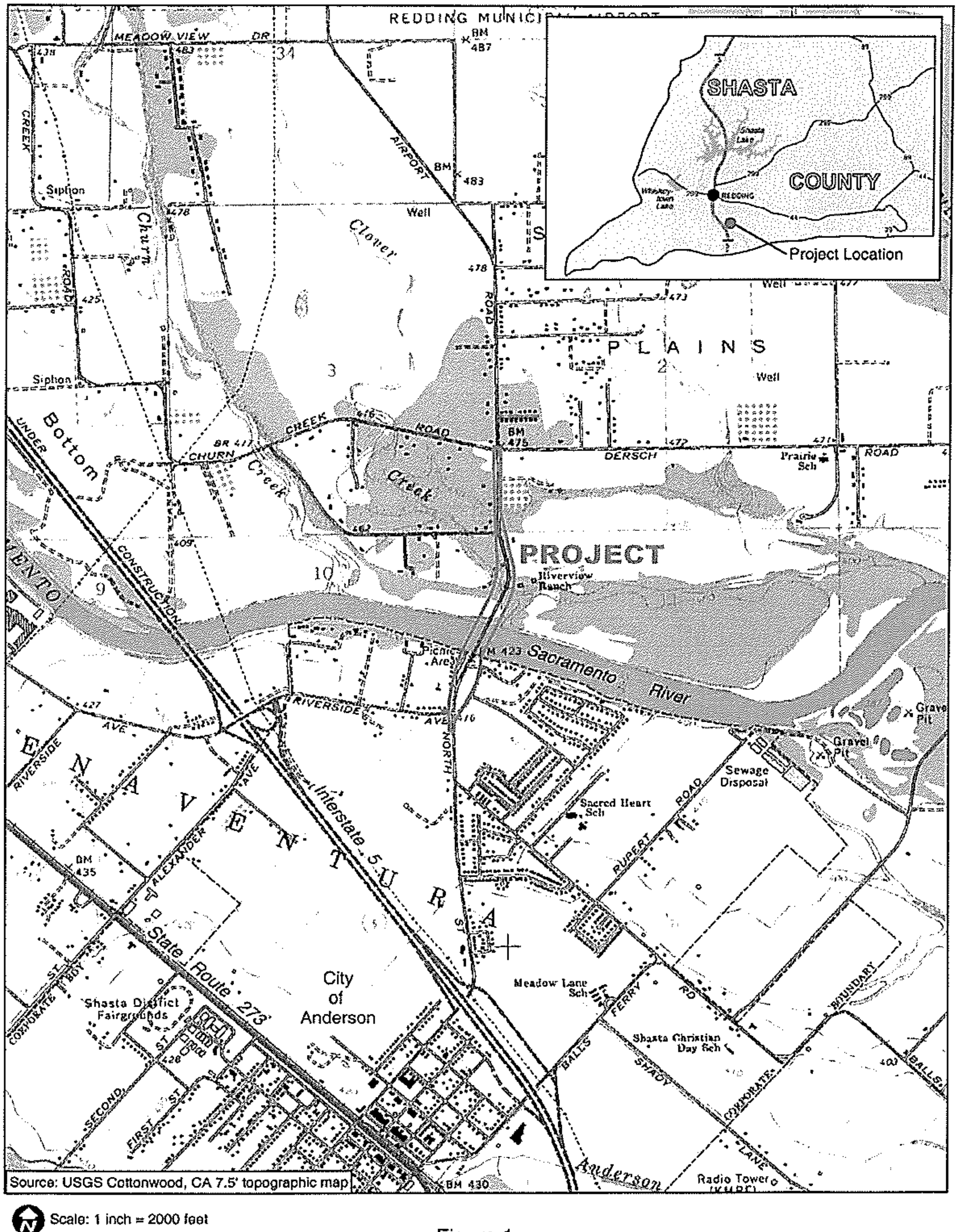

Figure 1
Project Location

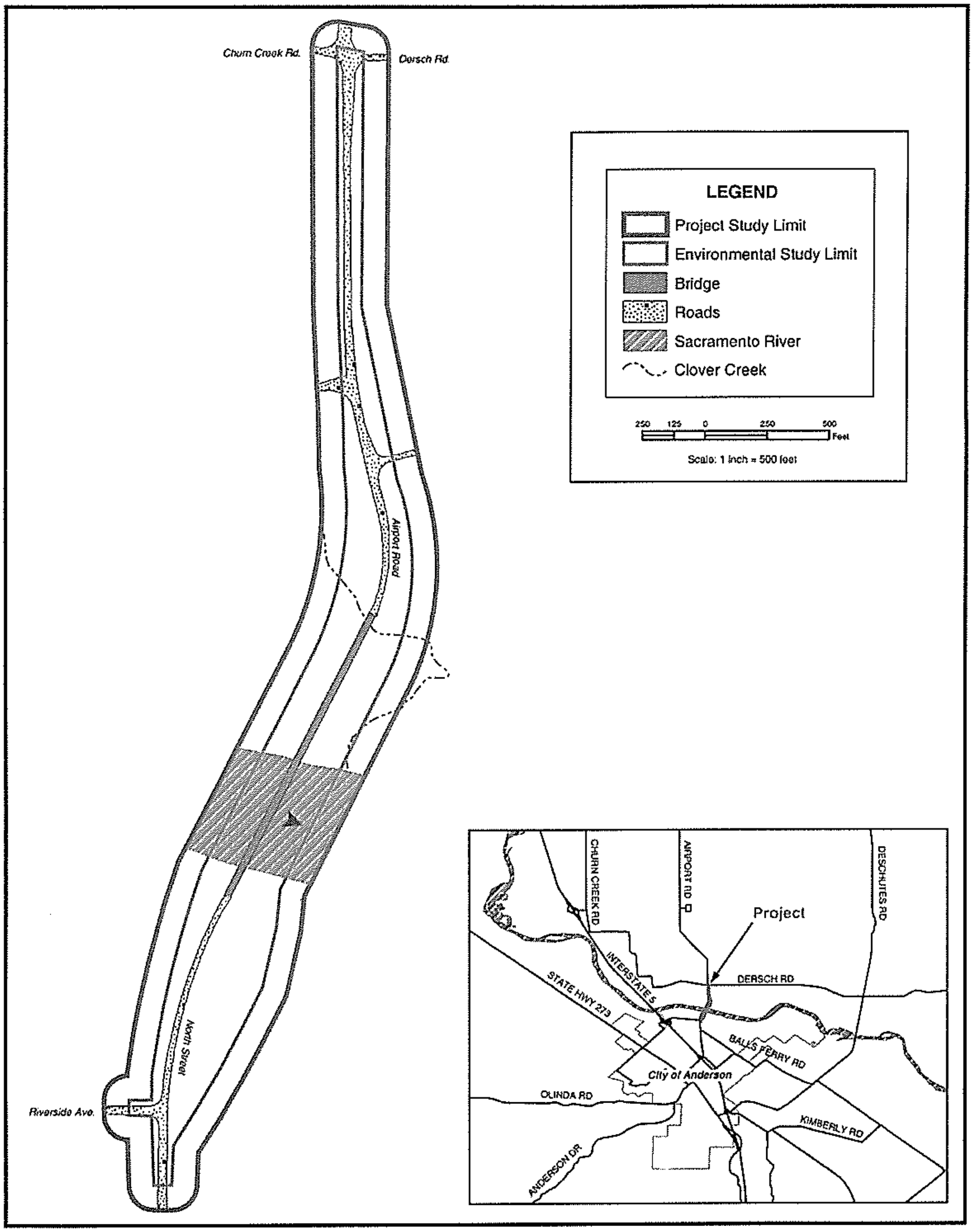

Figure 2
Study Area Boundary

cofferdam sheet piles (and any falsework) have been removed, the temporary work trestle and gravel work pads will be removed, working in reverse from the initial construction sequence.

Once the new bridge is open to traffic, removal of the old bridge can begin. Two new gravel work pads would be installed to facilitate bridge removal. The pads required for bridge demolition would be half as wide (35 feet) as the pads used for bridge construction; however, because the old bridge has four bents in the river, the work pads would need to extend to the center of the river channel (270 feet). Therefore, the two work pads would be installed separately (*i.e.*, a pad would be installed from one side of the river, that half of the bridge would be demolished, the pad would be removed, and then the second pad would be installed from the other side of the river). Utilizing the gravel work pads in this manner allows work to be completed without the installation of a temporary work trestle, eliminating a significant amount of pile driving. Demolition and removal of each half of the bridge is expected to be completed in 15 to 30 days.

Percussive work to occur within the Sacramento River between October 15 and April 15 is summarized as follows:

<u>Construction</u>

- Placing cofferdams for bent footings. Duration: 15 days.
- Driving steel H-piles for the foundation, beginning immediately after cofferdams are excavated. Duration: 15 days.
- Building work trestle, which includes driving temporary piles. This work should begin right after steel H-piles are driven. Duration: approximately 40 days.
- Removal of cofferdams. Duration: 5 days.

<u>Demolition</u>

- Placing cofferdams around the old pier walls to facilitate demolition. Duration: 20 days.
- Removal of piers and cofferdams. Duration: approximately 20 days

B. Proposed Conservation Measures

1. <u>Loss of Shaded Riverine Aquatic (SRA) and Riparian Habitat</u>

Measures to be taken to avoid such loss include the following:

- Minimizing the width of the construction disturbance zone within the riparian habitat through careful pre-construction planning.
- Erecting construction fencing along the outer edges of the construction zone where needed to prevent accidental entry into riparian habitat.
- Mature cottonwoods and valley oaks located near construction areas shall be flagged and avoided during construction.
- Stockpiling equipment and materials outside of the riparian habitat.

Unavoidable impacts to SRA and riparian habitat shall be offset by creating or restoring these communities onsite following the completion of construction. Onsite creation/restoration shall occur in areas disturbed during project construction. The amount of habitat created/restored shall be at least three times greater than the amount lost due to project implementation. Habitat creation/restoration work shall be conducted as described in Proposed Revegetation Plan (Shasta County 2005). If the required amount (3:1) of habitat restoration can only be partially achieved onsite, the remaining balance shall be fulfilled by purchasing mitigation credits at the California Department of Fish and Game's Battle Creek Mitigation Bank.

2. <u>Placement of Gravel Pads within the Sacramento River Channel</u>.

Gravel work pads shall be constructed and managed to minimize the mortality of incubating embryos and rearing juveniles, and to enhance salmonid spawning habitat in the vicinity. Shasta County shall implement one of the following two methods/schedules for gravel work pad placement to minimize the mortality of listed and proposed species during construction of the new bridge. The first is preferable for Shasta County, but both are acceptable.

1. Between August 15 and September 15, anti-spawning mats shall be installed in the expected footprints of the future gravel work pads. The mats shall remain in place for at least 60 days, after which time they shall be removed and immediately replaced with clean gravel fill.

2. The gravel work pads shall be placed within the channel between April 15 and May 1. Anti-spawning mats will not be utilized under this option. The pads shall be maintained through the spring and summer, until needed for bridge construction beginning around October 15.

Shasta County shall implement one of the following two methods/schedules for gravel work pad placement to minimize mortality during removal of the existing bridge.

1. Between August 15 and September 15, anti-spawning mats shall be installed in the expected footprints of the future gravel work pads. The mats shall remain in place for at least 60 days. At the time of their removal, the mats shall be immediately replaced with clean gravel fill. The objective of this approach would be to remove the bridge between October 15 and April 15.

2. The first gravel work pad shall be installed in the channel between March 1 and March 15 and removed immediately after the first half of the bridge has been demolished. The following year, the second gravel work pad shall be installed in the channel between March 1 and March 15 and removed immediately after the second half of the bridge has been demolished. The objective of this approach would be to remove the bridge between March 1 and April 15 of the two years in which demolition would be conducted. Anti-spawning mats will not be utilized under this option.

Material used for gravel work pads shall consist of uncrushed, rounded natural river rock with no sharp edges and be of a size between 1 and 4 inches in diameter. The gravel shall be washed and shall meet Caltrans Gravel Cleanliness Specification #85 to minimize the introduction of fine sediments into the river. Gravel that is to be removed and placed back into the river at a different location during construction of the project shall be rinsed off at an offsite facility to remove any sediment accumulation. Gravel shall be placed slowly and deliberately in the active flow channel to drive away rearing juveniles and migrating adults from the disturbance zone. The gravel pads shall be maintained for the duration of their use period. Upon completion of use, gravel used to construct the work pads shall be left in place to the extent possible (subject to approval from the Reclamation Board) to wash downstream and replenish spawning gravels.

The placement of gravel work pads is also expected to temporarily alter the flow patterns and hydrology within portions of the construction zone that will be heavily affected by percussive construction activities. This temporary change in localized hydrology is expected to render some of these areas unsuitable for spawning, thereby reducing impacts on listed species that may have otherwise spawned within these high impact zones.

3. Limiting the Work Window for In-channel Construction Activities.

Measures shall be taken to minimize incidental take of listed and proposed anadromous fish by restricting and isolating in-channel work to avoid vulnerable life stages. All in-channel percussive work shall be restricted to the period between October 15 and April 15 of each calendar year. Percussive work includes all pile driving and pile removal activities that utilize "hammering." Limiting percussive work to this period will allow winter-run Chinook salmon to complete their spawning and incubation while no percussive work is conducted.

In-channel work shall not be conducted at night to afford fish quiet, unobstructed passage during night-time hours. In-channel work conducted between April 15 and October 15 shall be limited to non-percussive work. Such work shall be limited to placement of anti-spawning mats and gravel work pads, and activities conducted from the work pads.

4. Limiting and Monitoring Sound Pressure Levels.

Measures shall be taken to minimize the acoustical impacts of pile driving activities on listed and proposed anadromous fish (juveniles and adults) by limiting the sound pressure levels generated by the pile driving equipment to 180 decibels (dB). Sound pressure levels shall be monitored within the water column and the substrate of the Sacramento River when pile driving equipment is operating. Measurements shall be taken adjacent to the pile being driven at the time. Levels exceeding 180 dB shall be reported to the Sacramento Area Office of NMFS within 48 hours.

5. Inspection and Fish Rescue within Cofferdams.

A qualified fishery biologist shall inspect and sample the areas enclosed by cofferdams as soon as the cofferdams are completed to ensure that no salmonids have been trapped within the cofferdam. If any entrained salmonids are detected, they shall be removed and relocated to the open river channel. Cofferdams shall be checked periodically, especially following a high-flow event, to determine if additional fish salvaging is required.

6. Increased Turbidity and Sedimentation.

Adverse effects on anadromous fish and their downstream spawning habitat shall be avoided by implementing standard erosion control measures as well as any special measures that may be prescribed by the California Department of Fish and Game, Regional Water Quality Control Board and NMFS. Erosion control measures to be undertaken include the following:

- Construction activities with the potential to cause soil erosion shall be limited to the dry season (April 15 through October 15) unless special erosion control measures are implemented.

- All disturbed soils shall be seeded, mulched, and fertilized as needed prior to the onset of the rainy season. Fertilizers shall not be applied within 50 feet of stream channels.

- Hay bales, silt fences, sediment basins or other controls shall be used to prevent sediments from entering waterways.

- Cofferdams shall remain in place year around. This will minimize pile installation and removal, thus reducing sediment input into the river.

- The discharge of petroleum products and excavated materials shall be prohibited.

- Work shall be halted if a sediment plume is observed in the water.

- Regional Water Quality Control Board water quality objectives for the Sacramento River Basin shall be met. To ensure compliance, a Storm Water Pollution Prevention Plan (SWPPP) shall be prepared addressing soil stabilization, sediment control, waste management, and pollution control. A water quality monitoring and reporting program shall also be prepared and implemented, and any identified problems shall be promptly corrected.

7. Potential Spill of Hazardous Materials

Any construction equipment that may come in contact with the Sacramento River shall be inspected daily for leaks prior to entering the flowing channel. External oil, grease, and mud will be removed from equipment using steam cleaning. Wash and rinse water must be adequately treated prior to discharge if that is the desired disposal option.

Hazardous materials, including fuels, oils, and solvents, will not be stored or transferred within 175 feet of the active Sacramento River channel. Areas for fuel storage, refueling, and servicing will be located at least 200 feet from the active river channel. Spill containment booms will be maintained onsite at all times during construction operations and/or staging of equipment or fueling supplies. Fueling trucks will carry a spill containment boom at all times.

C. Description of the Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). The action area, for the purpose of this biological opinion, centers on the Airport Road Bridge over the Sacramento River at 122° 17' 38" West; 40° 28' 21" North, in Shasta County, California, and encompasses an area that begins 500 feet upstream of the bridge and extends 500 feet downstream of the bridge. This area was selected because it represents the upstream and downstream extent of anticipated acoustic effects from pile driving, and the downstream extent of anticipated effects related to sediment and turbidity.

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

The following listed and proposed threatened and endangered species and designated critical habitat occur in the action area and may be affected by the proposed Airport Road Bridge Replacement project:

Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) – endangered
Sacramento River winter-run Chinook salmon critical habitat
Central Valley spring-run Chinook salmon (*O. tshawytscha*) – threatened
Central Valley spring-run Chinook salmon critical habitat
Central Valley steelhead (*O. mykiss*) – threatened
Central Valley steelhead critical habitat
Southern DPS of green sturgeon (*Acipenser medirostris*) – proposed threatened

A. Species and Critical Habitat Listing Status

Sacramento River winter-run Chinook salmon were originally listed as threatened in August 1989, under emergency provisions of the ESA, and formally listed as threatened in November 1990 (55 FR 46515). The Evolutionarily Significant Unit (ESU) consists of only one population that is confined to the upper Sacramento River in California's Central Valley. NMFS designated critical habitat for winter-run Chinook salmon on June 16, 1993 (58 FR 33212). They were reclassified as endangered on January 4, 1994 (59 FR 440), due to increased variability of run sizes, expected weak returns as a result of two small year classes in 1991 and 1993, and a 99 percent decline between 1966 and 1991. Critical habitat area was delineated as the Sacramento River from Keswick Dam, (river mile (RM) 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta (Delta), including Kimball Island, Winter Island, and Brown's Island; all waters from Chipps Island westward to the Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and the Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay north of the San Francisco-Oakland Bay Bridge.

Central Valley spring-run Chinook salmon were originally listed as threatened on September 16, 1999 (50 FR 50394). A recent status review resulted in an updated listing determination for Central Valley spring-run Chinook salmon as threatened on June 28, 2005 (70 FR 37160). This

ESU consists of spring-run Chinook salmon occurring in the Sacramento River basin. A final rule designating critical habitat for Central Valley spring-run Chinook salmon was published on September 2, 2005 (70 FR 52488). The rule becomes effective on January 2, 2006. The designation includes numerous streams and stream reaches throughout the Central Valley. The entire Sacramento River below Keswick Dam has been designated as critical habitat, including the action area.

Central Valley steelhead were originally listed as threatened under the ESA on March 19, 1998 (63 FR 13347). A recent status review has resulted in an updated proposed listing of Central Valley steelhead as threatened on June 14, 2004 (69 FR 33102). The final listing determination for Central Valley steelhead has not been issued. This ESU consists of steelhead populations in the Sacramento and San Joaquin River (inclusive of and downstream of the Merced River) basins in California's Central Valley. A final rule designating critical habitat for Central Valley steelhead was published on September 2, 2005 (70 FR 52488). The rule becomes effective on January 2, 2006. The designation includes numerous streams and stream reaches throughout the Central Valley. The entire Sacramento River below Keswick Dam has been designated as critical habitat, including the action area.

The critical habitat designations for these three species identify the primary constituent elements (PCEs) of critical habitat which include those physical and biological features of the habitat that are essential to the conservation of the species. Within the Sacramento River these PCEs include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors and estuarine areas. The PCEs of critical habitat for these species are made up of specific physical and biological components such as water of an appropriate quality and quantity, suitable spawning substrates, forage and food sources, and natural cover such as shade, submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

The southern DPS of North American green sturgeon was proposed for listing as threatened on April 6, 2005 (70 FR 17386). The southern DPS presently contains only a single spawning population in the Sacramento River, including the action area. No critical habitat has been designated or proposed for green sturgeon.

B. Species Life History and Population Dynamics

1. Chinook Salmon

a. *General Life History*

Chinook salmon exhibit two generalized freshwater life-history types (Healey 1991). "Stream-type" Chinook salmon enter freshwater months before spawning and reside in freshwater for a year or more following emergence, whereas "ocean-type" Chinook salmon spawn soon after entering freshwater and migrate to the ocean as fry or parr within their first year. Spring-run Chinook salmon exhibit a stream-type life history. Adults enter freshwater in the spring, hold over summer, spawn in fall, and the juveniles typically spend a year or more in freshwater before emigrating. Winter-run Chinook salmon are somewhat anomalous in that they have characteristics of both stream- and ocean-type races (Healey 1991). Adults enter freshwater in winter or early spring, and delay spawning until spring or early summer (stream-type). However, juvenile winter-run Chinook salmon migrate to sea after only four to seven months of river life (ocean-type). Adequate instream flows and cool water temperatures are more critical for the survival of Chinook salmon exhibiting a stream-type life history due to over summering by adults and/or juveniles.

Chinook salmon mature between two and six years of age (Myers *et al.* 1998). Freshwater entry and spawning timing generally are thought to be related to local water temperature and flow regimes (Miller and Brannon 1982). Runs are designated on the basis of adult migration timing; however, distinct runs also differ in the degree of maturation at the time of river entry, thermal regime and flow characteristics of their spawning site, and the actual time of spawning (Myers *et al.* 1998). Both spring-run and winter-run Chinook salmon tend to enter freshwater as immature fish, migrate far upriver, and delay spawning for weeks or months. For comparison, fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of the rivers, and spawn within a few days or weeks of freshwater entry (Healey 1991).

During their upstream migration, adult Chinook salmon require streamflows sufficient to provide olfactory and other orientation cues used to locate their natal streams. Adequate streamflows also are necessary to allow adult passage to upstream holding habitat. The preferred temperature range for upstream migration is 38 °F to 56 °F (Bell 1991; CDFG 1998). Adult winter-run Chinook salmon enter San Francisco Bay from November through June (Hallock and Fisher 1985) and migrate past Red Bluff Diversion Dam (RBDD) from mid-December through early August (NMFS 1997). The majority of the run passes RBDD from January through May, and peaks in mid-March (Hallock and Fisher 1985). The timing of migration may vary somewhat due to changes in river flows, dam operations, and water year type. Adult spring-run Chinook salmon enter the Delta from the Pacific Ocean beginning in January and enter natal streams from March to July (Myers *et al.* 1998). In Mill Creek, Van Woert (1964) noted that of 18,290 spring-run Chinook salmon observed from 1953 to 1963, 93.5 percent were counted between April 1 and July 14, and 89.3 percent were counted between April 29 and June 30. Typically, spring-run Chinook salmon utilize mid- to high elevation streams that provide appropriate temperatures and sufficient flow, cover, and pool depth to allow over-summering while conserving energy and allowing their gonadal tissue to mature.

Spawning Chinook salmon require clean, loose gravel in swift, relatively shallow riffles or along the margins of deeper runs, suitable water temperatures, depths, and velocities for redd construction, and adequate oxygenation of incubating eggs. Chinook salmon spawning typically occurs in gravel beds that are located at the tails of holding pools (FWS 1995a). The range of water depths and velocities in spawning beds that Chinook salmon find acceptable is very broad. Bell (1991) identifies the preferred water temperature for adult spring-run Chinook salmon migration as 38 °F to 56 °F. Boles (1988), recommends water temperatures below 65 °F for adult Chinook salmon migration, and Lindley *et al.* (2004) report that adult migration is blocked when temperatures reach 70 °F, and fish can become stressed as temperatures approach 70 °F. Reclamation reports that spring-run Chinook salmon holding over the summer prefer water temperatures below 60 °F, although salmon can tolerate temperatures up to 65 °F before they experience an increased susceptibility to disease. The upper preferred water temperature for spawning Chinook salmon is 55 °F to 57 °F (Chambers 1956; Reiser and Bjornn 1979). Winter-run Chinook salmon spawning occurs primarily from mid-April to mid-August, with the peak activity occurring in May and June in the Sacramento River reach between Keswick dam and RBDD (Vogel and Marine 1991). The majority of winter-run Chinook salmon spawners are three years old. Physical Habitat Simulation Model (PHABSIM) results (FWS 2003) indicate winter-run Chinook salmon suitable spawning velocities in the upper Sacramento River are between 1.54 feet per second (ft/s) and 4.10 ft/s, and suitable spawning substrates are between 1 and 5 inches in diameter. Initial habitat suitability curves (HSCs) show spawning suitability rapidly decreases for water depths greater than 3.13 feet (FWS 2003). Spring-run Chinook salmon spawning occurs between September and October, depending on water temperatures. Between 56 and 87 percent of adult spring-run Chinook salmon that enter the Sacramento River basin to spawn are 3 years old (Calkins *et al.* 1940; Fisher 1994). PHABSIM results indicate spring-run Chinook salmon suitable spawning velocities in Butte Creek are between 0.8 ft/s and 3.22 ft/s, and suitable spawning substrates are between 1 and 5 inches in diameter (FWS 2004). The initial HSC showed suitability rapidly decreasing for depths greater than one foot, but this effect was most likely due to the low availability of deeper water in Butte Creek with suitable velocities and substrates rather than a selection by spring-run Chinook salmon of only shallow depths for spawning (FWS 2004).

The optimal water temperature for egg incubation is 44 °F to 54 °F (Rich 1997). Incubating eggs are vulnerable to adverse effects from floods, siltation, desiccation, disease, predation, poor gravel percolation, and poor water quality. Studies of Chinook salmon egg survival to hatching conducted by Shelton (1955) indicated 87 percent of fry emerged successfully from large gravel with adequate subgravel flow. The length of time required for eggs to develop and hatch is dependent on water temperature and is quite variable. Alderdice and Velsen (1978) found that the upper and lower temperatures resulting in 50 percent pre-hatch mortality were 61 °F and 37 °F, respectively, when the incubation temperature was constant.

Winter-run Chinook salmon fry begin to emerge from the gravel in late June to early July and continue emerging through October (Fisher 1994), generally at night. Spring-run Chinook salmon fry emerge from the gravel from November to March and spend about 3 to 15 months in freshwater habitats prior to emigrating to the ocean (Kjelson *et al.* 1981). Post-emergent fry disperse to the margins of their natal stream, seeking out shallow waters with slower currents, finer sediments, and bank cover such as overhanging and submerged vegetation, root wads, and fallen woody debris, and begin feeding on small insects and crustaceans.

When juvenile Chinook salmon reach a length of 50 to 57 mm, they move into deeper water with higher current velocities, but still seek shelter and velocity refugia to minimize energy expenditures. In the mainstems of larger rivers, juveniles tend to migrate along the margins and avoid the elevated water velocities found in the thalweg of the channel. When the channel of the river is greater than 9 to 10 feet in depth, juvenile salmon tend to inhabit the surface waters (Healey 1982). Stream flow and/or turbidity increases in the upper Sacramento River basin are thought to stimulate emigration. Emigration of juvenile winter-run Chinook salmon past RBDD may begin as early as mid-July, typically peaks in September, and can continue through March in dry years (Vogel and Marine 1991; NMFS 1997). From 1995 to 1999, all winter-run Chinook salmon outmigrating as fry passed RBDD by October, and all outmigrating pre-smolts and smolts passed RBDD by March (Martin *et al.* 2001). Spring-run Chinook salmon emigration is highly variable (CDFG 1998). Some may begin outmigrating soon after emergence, whereas others over summer and emigrate as yearlings with the onset of intense fall storms (CDFG 1998). The emigration period for spring-run Chinook salmon extends from November to early May, with up to 69 percent of young-of-the-year outmigrants passing through the lower Sacramento River and Delta during this period (CDFG 1998).

Fry and parr may rear within riverine or estuarine habitats of the Sacramento River, Delta, and their tributaries. Spring-run Chinook salmon juveniles have been observed rearing in the lower part of non-natal tributaries and intermittent streams during the winter months (Maslin *et al.* 1997; Snider 2001). Within the Delta, juvenile Chinook salmon forage in shallow areas with protective cover, such as intertidal and subtidal mudflats, marshes, channels and sloughs (McDonald 1960; Dunford 1975). Cladocerans, copepods, amphipods, and larvae of diptera, as well as small arachnids and ants are common prey items (Kjelson *et al.* 1982; Sommer *et al.* 2001; MacFarlane and Norton 2002).

Winter-run Chinook salmon fry remain in the San Francisco Bay estuary until they reach a fork length of about 118 mm (*i.e.*, 5 to 10 months of age) and then begin emigrating to the ocean as early as November and continue through May (Fisher 1994; Myers *et al.* 1998). Little is known about estuarine residence time of spring-run Chinook salmon. Juvenile Chinook salmon were found to spend about 40 days migrating through the Delta to the mouth of San Francisco Bay and grew little in length or weight until they reached the Gulf of the Farallones (McFarlane and Norton 2002). Based on the mainly ocean-type life history observed (*i.e.*, fall-run Chinook salmon), MacFarlane and Norton (2002) concluded that unlike populations in the Pacific Northwest, Central Valley Chinook salmon show little estuarine dependence and may benefit from expedited ocean entry. Spring-run Chinook yearlings are larger in size than fall-run fish and are ready to smolt upon entering the Delta; therefore, they probably spend little time rearing in the Delta.

b. *Population Trend – Sacramento River Winter-run Chinook Salmon*

The distribution of winter-run Chinook salmon spawning and rearing historically was limited to the upper Sacramento River and tributaries, where spring-fed streams allowed for spawning, egg incubation, and rearing in cold water (Slater 1963; Yoshiyama *et al.* 1998). The headwaters of the McCloud, Pit, and Little Sacramento Rivers, and Hat and Battle Creeks, provided clean, loose gravel, cold, well-oxygenated water, and optimal flow in riffle habitats for spawning and incubation. These areas also provided the cold, productive waters necessary for egg and fry survival, and juvenile rearing over summer. Construction of Shasta Dam in 1943 and Keswick Dam in 1950 blocked access to all of these waters except Battle Creek, which is blocked by a weir at the CNFH and other small hydroelectric facilities (Moyle *et al.* 1989; NMFS 1997). Approximately, 299 miles of tributary spawning habitat in the upper Sacramento River is now blocked. Yoshiyama *et al.* (1998) estimated that the Upper Sacramento River in 1938 had a "potential spawning capacity" of 14,303 redds. Most components of the winter-run Chinook salmon life history (*e.g.*, spawning, incubation, freshwater rearing) have been compromised by the habitat blockage in the upper Sacramento River.

Following the construction of Shasta Dam, the number of winter-run Chinook salmon initially declined but recovered during the 1960s. The initial recovery was followed by a steady decline, subsequent to the construction of RBDD, from 1969 through the late 1980s (FWS 1981). Since 1967, the estimated adult winter-run Chinook salmon population ranged from 117,808 in 1969, to 186 in 1994 (NMFS 1997). The population declined from an average of 86,000 adults in 1967 to 1969 to only 1,900 in 1987 to 1989, and continued to remain low, with an average of approximately 2,500 fish for the period from 1998 to 2000 (Table 1). Between the time Shasta Dam was built and the listing of winter-run Chinook salmon as endangered, major impacts to the population occurred from warm water releases from Shasta Dam, juvenile and adult passage constraints at RBDD, water exports in the southern Delta, acid mine drainage from Iron Mountain Mine, and entrainment at a large number of unscreened or poorly-screened water diversions (NMFS 1997).

Population estimates from 2001 through 2004 show relatively consistent population levels with at least 4,000 more adults than any of the previous 15 years (Table 1). The 2005 run (15,829 fish) was the highest since the listing. Also, there is an increasing trend in the five year moving average (491 from 1990-1994 to 9,483 from 2000-2005); and the five year moving average of cohort replacement rates has increased and appears to have stabilized over the same period.

Table 1. Winter-run Chinook salmon population estimates from Red Bluff Diversion Dam counts, and corresponding cohort replacement rates for the years since 1986.

Year	Population Estimate (RBDD)	5 Year Moving Average Population Estimate	Cohort Replacement Rate	5 Year Moving Average of Cohort Replacement Rate
1986	2596	-	-	-
1987	2186	-	-	-
1988	2885	-	-	-
1989	696	-	0.27	-
1990	430	1759	0.20	-
1991	211	1282	0.07	-
1992	1240	1092	1.78	-
1993	387	593	0.90	0.64
1994	186	491	0.88	0.77
1995	1297	664	1.05	0.94
1996	1337	889	3.45	1.61
1997	880	817	4.73	2.20
1998	3002	1340	2.31	2.49
1999	3288	1961	2.46	2.80
2000	1352	1972	1.54	2.90
2001	8224	3349	2.74	2.76
2002	7441	4661	2.26	2.26
2003	8218	5705	6.08	3.02
2004	7701	6587	0.94	2.71
2005*	15,829	9,483	2.13	2.83

* Preliminary estimate as of 11/8/2005, subject to revision.

c. *Status - Sacramento River Winter-run Chinook Salmon and Critical Habitat*

Numerous factors have contributed to the decline of winter-run Chinook salmon through degradation of critical habitat PCEs such as spawning, rearing and migration habitats. The primary impacts include blockage of historical habitat by Shasta and Keswick Dams, warm water releases from Shasta Dam, juvenile and adult passage constraints at RBDD, water exports in the southern Delta, heavy metal contamination from Iron Mountain Mine, high ocean harvest rates, and entrainment in a large number of unscreened or poorly screened water diversions. Secondary factors include smaller water manipulation facilities and dams, low recruitment of spawning gravel due to blockage behind upstream dams, loss of rearing habitat in the lower Sacramento River and Delta from levee construction, marshland reclamation, and interaction with and predation by introduced species (NMFS 1997).

Since the listing of winter-run Chinook salmon and designation of critical habitat, several of the impacts to habitat PCEs that led to the decline of the species have been addressed and improved through restoration and conservation actions. The impetus for initiating restoration actions stem primarily from the following: (1) ESA section 7 consultation reasonable and prudent alternatives on temperature, flow, and operations of the Central Valley Project (CVP) and State Water Project; (2) SWRCB decisions requiring compliance with Sacramento River water temperature objectives which resulted in the installation of the Shasta Temperature Control Device in 1998; (3) a 1992 amendment to the authority of the CVP through the Central Valley Project Improvement Act (CVPIA) to give fish and wildlife equal priority with other CVP objectives; (4) fiscal support of habitat improvement projects from the CALFED Bay-Delta Program (*e.g.*, installation of a fish screen on the Glenn-Colusa Irrigation District diversion); (5) establishment of the CALFED Environmental Water Account (EWA); (6) Environmental Protection Agency (EPA) actions to control acid mine runoff from Iron Mountain Mine; and (7) ocean harvest restrictions implemented in 1995.

Due to these restoration and recovery efforts, several of the PCEs of winter-run Chinook salmon critical habitat have been improved and/or stabilized. Water temperatures in the upper river have generally been maintained within an acceptable range for winter-run migration, incubation and rearing. Suitable spawning gravel has been replenished through gravel augmentation programs below Keswick Dam, and migrational barriers have been reduced at RBDD and Anderson-Cottonwood Irrigation Dam (ACID).

The susceptibility of winter-run Chinook salmon to extinction remains linked to the elimination of access to their historical spawning grounds and the reduction of their population structure to a single, relatively small population. Recent trends in winter-run Chinook salmon abundance and cohort replacement are positive and may indicate some recovery since the listing. However, the population remains below the draft recovery goals established for the run (NMFS 1997). In general, the recovery criteria for winter-run Chinook salmon includes a mean annual spawning abundance over any 13 consecutive years to be 10,000 females and the geometric mean of the cohort replacement rate over those same years to be greater than 1.0.

d. *Population Trend – Central Valley Spring-run Chinook Salmon*

Historically, spring-run Chinook salmon were predominant throughout the Central Valley occupying the upper and middle reaches (1,000 to 6,000 feet) of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud and Pit Rivers, with smaller populations in most tributaries with sufficient habitat for over-summering adults (Stone 1874; Rutter 1904; Clark 1929). The Central Valley drainage as a whole is estimated to have supported spring-run Chinook salmon runs as large as 600,000 fish between the late 1880s and the 1940s (CDFG 1998). Before construction of Friant Dam, nearly 50,000 adults were counted in the San Joaquin River alone (Fry 1961). Following the completion of Friant Dam, the native population from the San Joaquin River and its tributaries (*i.e.*, the Stanislaus and Mokelumne Rivers) was extirpated. Spring-run Chinook salmon no longer exist in the American River due to the operation of Folsom Dam. Naturally-spawning populations of Central Valley spring-run Chinook salmon are currently restricted to accessible reaches of the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Feather River, Mill Creek, and Yuba River (CDFG 1998).

On the Feather River, significant numbers of spring-run Chinook salmon, as identified by run timing, return to the Feather River Hatchery (FRH). In 2002, FRH reported 4,189 returning spring-run Chinook salmon, which is 22 percent below the 10-year average of 4,727 fish. However, coded-wire tag (CWT) information from these hatchery returns indicates substantial introgression has occurred between fall-run and spring-run Chinook salmon populations in the Feather River due to hatchery practices. Because Chinook salmon are not temporally separated in the hatchery, spring-run Chinook and fall-run Chinook are spawned together, thus compromising the genetic integrity of the spring-run Chinook salmon. The number of naturally spawning spring-run Chinook salmon in the Feather River has been estimated only periodically since the 1960s, with estimates ranging from two fish in 1978 to 2,908 in 1964. The genetic integrity of this population is at question because there is significant temporal and spatial overlap between spawning populations of spring-run and fall-run Chinook salmon (Good *et al.* 2005). For the reasons discussed previously, Feather River spring-run Chinook population numbers are not included in the following discussion of ESU abundance.

Since 1969, the Central Valley spring-run Chinook salmon ESU (excluding Feather River fish) has displayed broad fluctuations in abundance ranging from 25,890 in 1982 to 1,403 in 1993 (CDFG unpublished data). Even though the abundance of fish may increase from one year to the next, the overall average population trend has a negative slope during this time period. The average abundance for the ESU was 12,499 for the period of 1969 to 1979, 12,981 for the period of 1980 to 1990, and 6,542 for the period of 1991 to 2001. In 2003 and 2004, total run size for the ESU was 8,775 and 9,872 adults respectively, well above the 1991-2001 average.

Evaluating the ESU as a whole, however, masks significant changes that are occurring among metapopulations. For example, while the mainstem Sacramento River population has undergone a significant decline, the tributary populations have demonstrated a substantial increase. Average abundance of Sacramento River mainstem spring-run Chinook salmon recently has declined from a high of 12,107 for the period 1980 to 1990, to a low of 609 for the period 1991 to 2001, while the average abundance of Sacramento River tributary populations increased from a low of 1,227 to a high of 5,925 over the same periods. Although tributaries such as Mill and Deer Creeks have shown positive escapement trends since 1991, recent escapements to Butte Creek, including 20,259 in 1998, 9,605 in 2001, and 8,785 in 2002 are responsible for much of the increase in tributary abundance (CDFG 2002a; CDFG, unpublished data). The Butte Creek estimates however, do not include prespawning mortality. In the last several years as the Butte Creek population has increased, mortality of adult spawners has increased from 21 percent in 2002 to 60 percent in 2003 due to disease associated with high water temperatures and over-crowding. This trend may indicate that the population in Butte Creek may have reached its carrying capacity (Ward *et al.* 2003) or are near historical population levels.

The extent of spring-run Chinook salmon spawning in the mainstem of the upper Sacramento River is unclear due to overlapping spawning periods with fall-run Chinook salmon. During aerial redd counts very few redds (less than 15 per year) were observed during September (generally accepted as the primary spawning period for spring-run Chinook salmon) from 1989 to 1993, and none in 1994 (FWS 2003). Recently, the number of redds in September has varied from 29 to 105 during 2001 though 2003 depending on the number of survey flights (CDFG, unpublished data). In 2002, based on RBDD ladder counts, 483 spring-run Chinook adults are estimated to have spawned in the mainstem Sacramento River (CDFG 2004). In 2003, that estimate dipped to zero, and in 2004 the number of spring-run Chinook adults estimated to have spawned in the mainstem Sacramento River was 575 (CDFG 2004).

e. *Status of Spring-run Chinook Salmon and Critical Habitat*

The initial factors that led to the decline of spring-run Chinook salmon were related to the loss of upstream habitat behind impassable dams. Since this initial loss of habitat, other factors have impacted spring-run Chinook salmon critical habitat, contributed to the instability of the population and affected the ESU's ability to recover. These factors include a combination of physical, biological, and management factors that have reduced the quantity and quality of critical habitat PCEs and directly reduced population numbers. Climatic variation, water management activities, hybridization with fall-run Chinook salmon, predation, and harvest have all impacted spring-run Chinook salmon critical habitat and population numbers (CDFG 1998).

Since spring-run Chinook salmon adults generally hold over for several months in small tributaries before pawning they are extremely susceptible to the effects of low flows and high water temperatures. During the drought from 1986 to 1992, Central Valley spring-run Chinook salmon populations declined substantially (CDFG 1998). Dry hydrologic conditions result in reduced flows and warm water temperatures which negatively impact adults, eggs, and juveniles. For adult spring-run Chinook salmon, reduced instream flows delay, or in some instances completely block access to holding and spawning habitats. Water management operations, including reservoir releases and unscreened or poorly-screened diversions along spring-run Chinook salmon migration routes, compound drought-related problems by further reducing river flows, warming river temperatures, and entraining juveniles.

Several actions have been taken to improve and increase the PCEs of critical habitat for spring-run Chinook salmon, including improved management of Central Valley water (*e.g.*, through use of CALFED EWA and CVPIA (b)(2) water accounts), implementing new and improved screen and ladder designs at major water diversions along the mainstem Sacramento River and tributaries, removal of several small dams on important spring-run Chinook salmon spawning streams, and changes in ocean and inland fishing regulations to minimize harvest. Although protective measures and critical habitat restoration likely have contributed to recent increases in spring-run Chinook salmon abundance, the ESU is still below levels observed from the 1960s through 1990. Threats from hatchery production (*i.e.*, competition for food between naturally-spawned and hatchery fish, and run hybridization and homogenization), climatic variation, reduced stream flow, high water temperatures, predation, and large scale water diversions persist. Because the Central Valley spring-run Chinook salmon ESU is confined to relatively few remaining streams and continues to display broad fluctuations in abundance, the population is at a moderate risk of extinction.

2. <u>Steelhead</u>

a. *General Life History*

Based on their state of sexual maturity at the time of river entry and the duration of their spawning migration, steelhead can be divided into two life history types: stream-maturing and ocean-maturing. Stream-maturing steelhead enter freshwater in a sexually immature condition and require several months to mature and spawn, whereas ocean-maturing steelhead enter freshwater with well-developed gonads and spawn shortly after river entry. These two life history types are more commonly referred to by their season of freshwater entry (*i.e.*, summer [stream-maturing] and winter [ocean-maturing] steelhead). Only winter steelhead are currently found in Central Valley rivers and streams (McEwan and Jackson 1996), although there are indications that summer steelhead were present in the Sacramento River system prior to the commencement of large-scale dam construction in the 1940s (Interagency Ecological Program [IEP] Steelhead Project Work Team 1999). At present, summer steelhead are found only in North Coast drainages, mostly in tributaries of the Eel, Klamath, and Trinity River systems (McEwan and Jackson 1996).

Winter steelhead generally leave the ocean from August through April, and spawn between December and May (Busby *et al.* 1996). Timing of upstream migration is correlated with higher flow events, such as freshets or sand bar breaches, and the associated lower water temperatures. The preferred water temperature for adult steelhead migration is 46 °F to 52 °F (McEwan and Jackson 1996; Myrick 1998; Myrick and Cech 2000). Thermal stress may occur at temperatures beginning at 66 °F and mortality has been demonstrated at temperatures beginning at 70 °F. The preferred water temperature for steelhead spawning is 39 °F to 52 °F, and the preferred water temperature for steelhead egg incubation is 48 °F to 52 °F (McEwan and Jackson 1996; Myrick 1998; Myrick and Cech 2000). The minimum stream depth necessary for successful upstream migration is 13 cm (Thompson 1972). Preferred water velocity for upstream migration is in the range of 40-90 cm/s, with a maximum velocity, beyond which upstream migration is not likely to occur, of 240 cm/s (Thompson 1972; Smith 1973).

Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby *et al.* 1996). However, it is rare for steelhead to spawn more than twice before dying; most that do so are females (Busby *et al.* 1996; Nickleson *et al.* 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996). Although one-time spawners are the great majority, Shapolov and Taft (1954) reported that repeat spawners are relatively numerous (17.2 percent) in California streams. Most steelhead spawning takes place from late December through April, with peaks from January though March (Hallock *et al.* 1961). Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity, and may spawn in intermittent streams as well (Everest 1973; Barnhart 1986).

The length of the incubation period for steelhead eggs is dependent on water temperature, dissolved oxygen concentration, and substrate composition. In late spring and following yolk sac absorption, fry emerge from the gravel and actively begin feeding in shallow water along stream banks (Nickelson *et al.* 1992).

Steelhead rearing during the summer takes place primarily in higher velocity areas in pools, although young-of-the-year also are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small woody debris. Cover is an important habitat component for juvenile steelhead both as velocity refuge and as a means of avoiding predation (Shirvell 1990; Meehan and Bjornn 1991). Some older juveniles move downstream to rear in large tributaries and mainstem rivers (Nickelson *et al.* 1992). Juveniles feed on a wide variety of aquatic and terrestrial insects (Chapman and Bjornn 1969), and emerging fry are sometimes preyed upon by older juveniles.

Steelhead generally spend two years in freshwater before emigrating downstream (Hallock *et al.* 1961; Hallock 1989). Rearing steelhead juveniles prefer water temperatures of 45 ° F to 58 °F and have an upper lethal limit of 75 °F. They can survive in water up to 81 °F with saturated dissolved oxygen conditions and a plentiful food supply. Reiser and Bjornn (1979) recommended that dissolved oxygen concentrations remain at or near saturation levels with temporary reductions no lower than 5.0 mg/l for successful rearing of juvenile steelhead. During rearing, suspended and deposited fine sediments can directly affect salmonids by abrading and clogging gills, and indirectly cause reduced feeding, avoidance reactions, destruction of food supplies, reduced egg and alevin survival, and changed rearing habitat (Reiser and Bjornn 1979). Bell (1973) found that silt loads of less than 25 mg/l permit good rearing conditions for juvenile salmonids.

Juvenile steelhead emigrate episodically from natal streams during fall, winter, and spring high flows. Emigrating Central Valley steelhead use the lower reaches of the Sacramento River and the Delta for rearing and as a migration corridor to the ocean. Some may utilize tidal marsh areas, non-tidal freshwater marshes, and other shallow water areas in the Delta as rearing areas for short periods prior to their final emigration to the sea. Barnhart (1986) reported that steelhead smolts in California range in size from 140 to 210 mm (fork length). Hallock *et al.* (1961) found that juvenile steelhead in the Sacramento River basin migrate downstream during most months of the year, but the peak period of emigration occurred in the spring, with a much smaller peak in the fall.

b. *Population Trends – Central Valley Steelhead*

Steelhead historically were well-distributed throughout the Sacramento and San Joaquin Rivers (Busby *et al.* 1996). Steelhead were found from the upper Sacramento and Pit River systems (now inaccessible due to Shasta and Keswick Dams), south to the Kings and possibly the Kern River systems (now inaccessible due to extensive alteration from water diversion projects), and in both east and west-side Sacramento River tributaries (Yoshiyama *et al.* 1996). The present distribution has been greatly reduced (McEwan and Jackson 1996). The California Advisory Committee on Salmon and Steelhead (1988) reported a reduction of steelhead habitat from 6,000 miles historically to 300 miles today. Historically, steelhead probably ascended Clear Creek past the French Gulch area, but access to the upper basin was blocked by Whiskeytown Dam in 1964 (Yoshiyama *et al.* 1996). Steelhead also occurred in the upper drainages of the Feather, American, Yuba and Stanislaus Rivers which are now inaccessible (McEwan and Jackson 1996, Yoshiyama *et al.* 1996).

Historic Central Valley steelhead run size is difficult to estimate given the paucity of data, but may have approached one to two million adults annually (McEwan 2001). By the early 1960s, the steelhead run size had declined to about 40,000 adults (McEwan 2001). Over the past 30 years, the naturally-spawned steelhead populations in the upper Sacramento River have declined substantially. Hallock *et al.* (1961) estimated an average of 20,540 adult steelhead in the Sacramento River, upstream of the Feather River, through the 1960s. Steelhead counts at the RBDD declined from an average of 11,187 for the period of 1967 to 1977, to an average of approximately 2,000 through the early 1990s, with an estimated total annual run size for the entire Sacramento-San Joaquin system, based on RBDD counts, to be no more than 10,000 adults (McEwan and Jackson 1996, McEwan 2001). Steelhead escapement surveys at RBDD ended in 1993 due to changes in dam operations.

Nobriga and Cadrett (2003) compared CWT and untagged (wild) steelhead smolt catch ratios at Chipps Island trawl from 1998 to 2001 and estimated that about 100,000 to 300,000 steelhead juveniles are produced naturally each year in the Central Valley. In the draft *Updated Status Review of West Coast Salmon and Steelhead* (Good *et al.* 2005), the Biological Review Team (BRT) made the following conclusion based on the Chipps Island data:

> "If we make the fairly generous assumptions (in the sense of generating large estimates of spawners) that average fecundity is 5,000 eggs per female, 1 percent of eggs survive to reach Chipps Island, and 181,000 smolts are produced (the 1998-2000 average), about 3,628 female steelhead spawn naturally in the entire Central Valley. This can be compared with McEwan's (2001) estimate of 1 million to 2 million spawners before 1850, and 40,000 spawners in the 1960s".

The only consistent data available on steelhead numbers in the San Joaquin River basin come from CDFG mid-water trawling samples collected on the lower San Joaquin River at Mossdale. These data indicate a decline in steelhead numbers in the early 1990s, which have remained low through 2002 (CDFG 2003). In 2004, a total of 12 steelhead smolts were collected at Mossdale (CDFG, unpublished data).

Existing wild steelhead stocks in the Central Valley are mostly confined to the upper Sacramento River and its tributaries, including Antelope, Deer, and Mill Creeks and the Yuba River. Populations may exist in Big Chico and Butte Creeks and a few wild steelhead are produced in the American and Feather Rivers (McEwan and Jackson 1996).

Recent snorkel surveys (1999 to 2002) indicate that steelhead are present in Clear Creek (J. Newton, FWS, pers. comm. 2002, as reported in Good *et al.* 2005). Because of the large resident *O. mykiss* population in Clear Creek, steelhead spawner abundance has not been estimated.

Until recently, steelhead were thought to be extirpated from the San Joaquin River system. Recent monitoring has detected small self-sustaining populations of steelhead in the Stanislaus, Mokelumne, Calaveras, and other streams previously thought to be void of steelhead (McEwan 2001). On the Stanislaus River, steelhead smolts have been captured in rotary screw traps at Caswell State Park and Oakdale each year since 1995 (Demko *et al.* 2000). It is possible that naturally spawning populations exist in many other streams but are undetected due to lack of monitoring programs (IEP Steelhead Project Work Team 1999).

c. *Status of Central Valley Steelhead and Critical Habitat*

Both the BRT (Good *et al.* 2005) and the Artificial Propagation Evaluation Workshop (69 FR 33102) concluded that the Central Valley steelhead ESU is "in danger of extinction." However, in the proposed status review NMFS concluded that the ESU in-total is "not in danger of extinction, but is likely to become endangered within the foreseeable future" citing benefits of restoration efforts and a yet-to-be funded monitoring program (69 FR 33102). Central Valley steelhead have already been extirpated from most of their historical range. Critical habitat concerns for steelhead focus on the widespread degradation, destruction, and blockage of freshwater habitat within the region, and impacts to PCEs are similar to those discussed for Chinook salmon above. Widespread hatchery steelhead production within this ESU also raises concerns about the potential ecological interactions between introduced stocks and native stocks. Because the Central Valley steelhead population has been fragmented into smaller isolated tributaries without any large source population and the remaining habitat continues to be degraded by water diversions and other land use practices, the population is at high risk of extinction.

3. <u>Southern DPS of North American Green Sturgeon</u>

The green sturgeon is the most widely distributed member of the sturgeon family Acipenseridae (70 FR 17386). North American green sturgeon are found in rivers from British Columbia south to the Sacramento River, California, though their ocean range is from the Bering Sea to Ensenada, Mexico (Moyle 2002). In assessing North American green sturgeon status, NMFS determined that two DPSs exist. The northern DPS is made up of known North American green sturgeon spawning (or single stock populations) in the Rogue, Klamath and Eel rivers. The southern DPS presently contains only a single spawning population in the Sacramento River (70 FR 17386). NMFS proposed to list the southern DPS of North American green sturgeon as threatened on April 6, 2005 (70 FR 17386).

a. *Life History*

North American green sturgeon is an anadromous species that generally migrate upstream into fresh water between late February and late July (CDFG 2002b). In the Klamath River, the water temperature tolerance of immigrating adult North American green sturgeon reportedly ranges from 44.4 °F to 60.8 °F (6.9 °C to 16 °C); North American green sturgeon were not found in areas of the river outside this surface water temperature range (FWS 1995b). Mature males range from 139 to 199 centimeters (cm) fork length (FL) and 15 to 30 years of age (Van Eenennaam *et al.* 2001). Mature females range from 157 to 223 cm FL and 17 to 40 years of age. Maximum ages of adult North American green sturgeon are likely to range from 60 to 70 years (Moyle 2002).

Adult North American green sturgeon are thought to spawn every three to five years (70 FR 17386), but new information suggests that spawning could occur as frequently as every two years (Stephen Lindley, NMFS, pers. comm., 2004). Spawning occurs from March through July, with peak activity from April through June (Moyle *et al.* 1995). North American green sturgeon appear to spawn within 200 miles (322 km) of the ocean. Spawning occurs in deep turbulent river mainstems. Specific spawning habitat preferences are unclear, but eggs likely are broadcast over large cobble where they settle into the cracks (Moyle *et al.* 1995). North American green sturgeon reportedly prefer to spawn in water temperatures ranging from 46.4 °F to 57.2 °F (8 °C to 14 °C) (FWS 1995b; Environmental Protection Information Center *et al.* 2001; Moyle 2002). Water temperatures above 68 °F (20 °C) are reportedly lethal to North American green sturgeon embryos (Cech *et al.* 2000; Beamesderfer and Webb 2002). North American green sturgeon females produce 60,000 - 140,000 eggs (Moyle *et al.* 1992), and they are the largest eggs (diameter 4.34 mm) of any sturgeon species (Cech *et al.* 2000).

North American green sturgeon larvae hatch at around 200 hours (at 54.9° F) after spawning, and are dissimilar to other sturgeon species in that they lack a distinct swim-up or post-hatching stage (Moyle 2002; NMFS 2002). Optimal growth rates for North American green sturgeon juveniles reportedly occur at water temperatures of 59 °F (Cech *et al.* 2000). North American green sturgeon larvae first feed at 10 days post hatch and grow quickly reaching a length of 66 mm and a weight of 1.8 g in three weeks of exogenous feeding. Metamorphosis to the juvenile stage is complete at 45 days. Juveniles continue to grow rapidly, reaching 300 mm in one year. Juveniles spend from one to four years in fresh and estuarine waters and disperse into salt water at lengths of 300 to 750 mm.

The North American green sturgeon is the most marine oriented of the Pacific Coast sturgeon species (NMFS 2003). Individuals apparently remain near the estuaries at first, but then migrate considerable distances in the ocean as they grow. Based on recoveries of North American green sturgeon tagged in the San Francisco Bay estuary, most North American green sturgeon migrate northward, in some cases as far as British Columbia (Moyle 2002; NMFS 2002). Similarly, tagged North American green sturgeon from the Sacramento and Columbia rivers are primarily captured to the north in coastal and estuarine waters, with some fish tagged in the Columbia River being recaptured as far north as British Columbia (Washington Department of Fish and Wildlife (WDFW) 2002). While there is some bias associated with recovery of tagged fish through commercial fishing, the pattern of a northern migration is supported by the large concentration of North American green sturgeon in the Columbia River estuary, Willapa Bay, and Grays Harbor, which peaks in August. These fish tend to be immature; however, mature fish and at least one ripe fish have been found in the lower Columbia River (WDFW 2002). Genetic evidence suggests that most Columbia River green sturgeon are a mixture of fish spawned in other river systems including the Sacramento, Klamath, and Rogue Rivers (Israel *et al.* 2002).

Some general information is available on North American green sturgeon feeding habits. Adult North American green sturgeon scour the Sacramento-San Joaquin Delta benthos for invertebrates including shrimp, mollusks, amphipods, isopods, and small, disabled or dead fish (Environmental Protection Center *et al.* 2001). The primary diet for juvenile North American green sturgeon reportedly consists of small crustaceans, such as amphipods and opossum shrimp (CDFG 2001a). As juvenile North American green sturgeon develop, they reportedly eat a wider variety of benthic invertebrates, including clams, crabs, and shrimp (CDFG 2001a).

b. *Southern DPS of North American Green Sturgeon Population Status*

Population abundance information concerning the Southern DPS of North American green sturgeon is scant as described in the status review (NMFS 2002). Limited population abundance information comes from incidental captures of North American green sturgeon from the white sturgeon *(Acipenser transmontanus)* monitoring program by the CDFG sturgeon tagging program (CDFG 2002c). CDFG (2002c) utilizes a multiple-census or Peterson mark-recapture method to estimate the legal population of white sturgeon captures in trammel nets. By comparing ratios of white sturgeon to green sturgeon captures, CDFG provides estimates of adult and sub-adult North American green sturgeon abundance. Estimated abundance between 1954 and 2001 ranged from 175 fish to more than 8,000 per year and averaged 1,509 fish per year. Unfortunately, there are many biases and errors associated with these data, and CDFG does not consider these estimates reliable. Fish monitoring efforts at Red Bluff Diversion Dam and Glen Colusa Irrigation District on the upper Sacramento River have captured between 0 and 2,068 juvenile North American green sturgeon per year, mostly between June and July (NMFS 2002). The only existing information regarding changes in the abundance of the Southern DPS of North American green sturgeon includes changes in abundance at the John Skinner Fish Protection Facility between 1968 and 2001 (State facility). The estimated average annual number of North American green sturgeon taken at the State Facility prior to 1986 was 732; from 1986 on, the average annual number was 47 (70 FR 17386). For the Tracy Fish Collection Facility (Federal facility), the average annual number prior to 1986 was 889; from 1986 to 2001 it was 32 (70 FR 17386). In light of the increased exports, particularly during the previous 10 years, it is clear that the abundance of the Southern DPS of North American green sturgeon is dropping. Catches of sub-adult and adult North American green sturgeon by the IEP between 1996 and 2004 ranged from 1 to 212 green sturgeon per year (212 occurred in 2001), however, the portion of these catches that were made up of the Southern DPS of North American green sturgeon is unknown as these captures were primarily located in San Pablo Bay which is known to consist of a mixture of the Northern and Southern population segments. Additional analysis of North American green and white sturgeon taken at the State and Federal facilities indicates that take of both North American green and white sturgeon per acre-foot of water exported has decreased substantially since the 1960's (70 FR 17386).

Larval and post larval North American green sturgeon are caught each year in rotary screw traps at the Red Bluff Diversion Dam (Gaines and Martin 2001). A total of 2,608 juvenile sturgeon were captured from 1994-2000. All were assumed to be North American green sturgeon since 124 of these fish were grown by University of California Davis researchers to an identifiable size and all were North American green sturgeon. Young sturgeon appear in catches from early May through August. Most range in size from 1 to 3 inches. Catch rates were greatest in 1995 and 1996 and were lowest in 1999 and 2000 (Gaines and Martin 2001).

No North American green sturgeon have been detected during intensive salmonid monitoring efforts in Clear, Battle, Butte, Deer and Mill creeks, all of which are tributaries to the Sacramento River (Matt Brown, FWS, pers. comm., 2004; Colleen Harvey-Arrison, CDFG, pers. comm., 2004). Sampling on these tributaries includes monitoring adult passage at fish ladders (Battle Creek), snorkel surveys (Deer, Butte, Clear and Battle creeks), and rotary screw trapping (Deer, Mill, Clear, Battle and Butte creeks). Much of this monitoring has occurred during time periods when adult North American green sturgeon would be expected to be in the rivers spawning, and when juvenile North American green sturgeon would be expected to be hatching, rearing and migrating through the river systems (S.P. Cramer & Associates, Inc. 2004).

Similar monitoring activities have likewise failed to detect North American green sturgeon in the American River (Mike Healey, CDFG, pers. comm., 2004; John Hannon, U.S. Bureau of Reclamation, pers. comm., 2004; Trevor Kennedy, Fishery Foundation of California, pers. comm., 2004). These sampling efforts included snorkeling, rotary screw trapping, and seining, and were conducted during periods when adult and juvenile North American green sturgeon would have been expected to be in the river (S.P. Cramer & Associates, Inc. 2004).

Green and white sturgeon adults have been observed periodically in small numbers in the Feather River (S.P. Cramer & Associates, Inc.2004). There are at least two confirmed records of adult North American green sturgeon. There are no records of larval or juvenile sturgeon of either species, even prior to the 1960s when Oroville Dam was built. There are reports that North American green sturgeon may reproduce in the Feather River during high flow years (CDFG 2002c), but these are not specific and are unconfirmed (S.P. Cramer & Associates, Inc. 2004).

c. *Factors Affecting the Southern DPS of North American Green Sturgeon*

The principal factor for the decline of North American green sturgeon reportedly comes from the reduction of spawning habitat to a limited area of the Sacramento River (70 FR 17391). Keswick Dam is an impassible barrier blocking North American green sturgeon access to what are thought to have been historic spawning grounds upstream (70 FR 17386). In addition, a substantial amount of what may have been spawning and rearing habitat in the Feather River above Oroville Dam has also been lost (70 FR 17386). There is a lack of historical information on presence or absence of North American green sturgeon spawning in the Feather River, and it remains unclear whether suitable spawning habitat currently is available or has ever been available in the section of the Feather River that is currently accessible (S.P. Cramer & Associates, Inc. 2004).

Potential adult migration barriers to the Southern DPS of North American green sturgeon include RBDD, Sacramento Deep Water Ship Channel locks, Fremont Weir, Sutter Bypass, and the Delta Cross Channel Gates on the Sacramento River, and Shanghai Bench and Sunset Pumps on the Feather River (70 FR 17391). The threat of screened and unscreened agricultural, municipal, and industrial water diversions in the Sacramento River and Delta to North American green sturgeon are largely unknown as juvenile sturgeon are often not identified, and the current CDFG and NMFS' screen criteria are not specifically designed to protect sturgeon. Based on the temporal occurrence of juvenile North American green sturgeon and the high density of water diversion structures along rearing and migration routes, the potential threat of these diversions are found to be serious and in need of study (70 FR 17391).

CDFG (1992) found a strong correlation between mean daily freshwater outflow (April to July) and white sturgeon year class strength in the Sacramento-San Joaquin Estuary, suggesting that insufficient flow rates are likely to pose a significant threat to the Southern DPS of North American green sturgeon. It is postulated that low flow rates could dampen survival by hampering the dispersal of larvae to areas of greater food availability, hampering the dispersal of larvae to all available habitat, delaying the transportation of larvae downstream of water diversions in the Delta, or decreasing nutrient supply to the nursery, thus stifling productivity (CDFG 1992). The subject studies primarily involve the more abundant white sturgeon; however, the threats to North American green sturgeon are thought to be similar (70 FR 17391). It is important to note, however, that white sturgeon spend more time in a riverine environment than North American green sturgeon, and the aforementioned correlation may not be applicable. The full relationship between flow and North American green sturgeon year class strength has not yet been determined.

The installation of the Shasta Dam temperature control device in 1997 is thought to have improved the situations related to high water temperatures in the upper Sacramento River, although Shasta Dam has a limited storage capacity and cold water reserves could be depleted in long droughts. Water temperatures at RBDD have not been higher than 62 °F since 1995 and are within the North American green sturgeon egg and larvae optimum range for growth and survival of 59 to 66 °F (Mayfield and Cech 2004). Conversely, CDFG (2002c) has indicated that water temperatures may be inadequate for spawning and egg incubation in the Feather River during many years as the result of releases of warmed water from Thermalito Afterbay. It is likely that high water temperatures (greater than 63 °F) may deleteriously affect sturgeon egg and larval development, especially for late-spawning fish in drier water years (70 FR 17386).

Non-native species are an ongoing problem in the Sacramento-San Joaquin River and Delta systems (CDFG 2002c). One risk for North American green sturgeon associated with the introduction of non-native species involves the replacement of relatively uncontaminated food items with those that may be contaminated. For example, the non-native overbite clam, *Potamocorbula amurensis*, introduced in 1988, has become the most common food of white sturgeon and was found in the only North American green sturgeon examined thus far (CDFG 2002c). The overbite clam is known to bioaccumulate selenium, a toxic metal (CDFG 2002c; Linville *et al.* 2002). The significance of this threat to North American green sturgeon is unclear. North American green sturgeon also are likely to experience predation by introduced species including striped bass, but the actual impacts of predation have yet to be estimated (70 FR 17392).

Contamination of the Sacramento River increased substantially in the mid-1970s when application of rice pesticides increased (70 FR 17386). Estimated toxic concentrations for the Sacramento River during 1970-1988 may have deleteriously affected striped bass larvae (Bailey *et al.* 1994). White sturgeon also may accumulate PCBs and selenium (White *et al.* 1989). While North American green sturgeon spend more time in the marine environment than white sturgeon and, therefore, may have less exposure, the Biological Review Team for North American green sturgeon has concluded that contaminants also pose some risk for North American green sturgeon. However, this risk has not been quantified or estimated.

Existing efforts are being carried out to protect North American green sturgeon. The Central Valley Project Improvement Act (CVPIA) is a Federal act directing the Secretary of the Interior to amend previous authorizations of California's Central Valley Project to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic use, and fish and wildlife enhancement as a project purpose equal to power generation. Since the CVPIA was enacted in 1992, FWS and the U.S. Bureau of Reclamation have led an effort to implement a significant number of activities across the Central Valley including projects such as (1) river restoration, (2) land purchases, (3) fish screen projects, (4) water acquisitions for the environment, and (5) special studies and investigations. The Anadromous Fish Restoration Program (AFRP), a component of the CVPIA, implements a doubling program in an attempt to *"implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991."* The AFRP specifically applies the doubling effort toward Chinook salmon, Central Valley steelhead, striped bass, and white and North American green sturgeon. Though most efforts of the AFRP have primarily focused on Chinook salmon as a result of their listing history and status, North American green sturgeon may receive some unknown amount of benefit from these restoration efforts. For example, the acquisition of water for flow enhancement on tributaries to the Sacramento River, fish screening for the protection of Chinook salmon and Central Valley steelhead, or riparian revegetation and instream restoration projects likely would have some ancillary benefits to sturgeon. The AFRP also has invested in one North American green sturgeon research project that has helped improve our understanding of the life history requirements and temporal distribution patterns of North American green sturgeon within the southern DPS (70 FR 17398).

The California Bay-Delta Program (CALFED) is a cooperative effort of more than 20 State and Federal agencies designed to improve water quality and reliability of California's water supply while recovering the Central Valley ecosystem. The CALFED program contains four key objectives, which include water quality, ecosystem quality, water supply and levee system integrity. Many notable beneficial actions have originated and been funded by the CALFED program including such projects as floodplain and instream restoration, riparian habitat protection, fish screening and passage projects, research regarding non-native invasive species and contaminants, restoration methods, and watershed stewardship and education and outreach programs (70 FR 17398). Prior Federal Register notices have reviewed the details of CVPIA and

CALFED programs and potential benefits towards anadromous fish, particularly Chinook salmon and Central Valley steelhead (69 FR 33102).

Information received from CALFED regarding potential projects that may serve as conservation measures for North American green sturgeon indicated a total of 118 projects of various types and levels of progress funded between 1995 and 2004. Projects primarily consisted of fish screen evaluation and construction projects, restoration evaluation and enhancement activities, contaminations studies, and dissolved oxygen investigations related to the San Joaquin River Deep Water Ship Channel. Two evaluation projects specifically addressed North American green sturgeon while the remaining projects primarily address anadromous fish in general, particularly listed salmonids. The new North American green sturgeon information from research will be used to enhance our understanding of the risk factors affecting the species, thereby improving our ability to develop effective management measures. However, at present they do not directly help to alleviate threats that this species faces in the wild (70 FR 17398). All ongoing fish screen and passage studies are designed primarily to meet the minimum qualifications outlined by the NMFS and CDFG fish screen criteria. Though these improvements will likely benefit salmonids, there is no evidence showing that these measures will decrease the likelihood of North American green sturgeon mortality. While one of CALFED's goals is to recover a number of at-risk species (including North American green sturgeon) and the program has and continues to provide funding for a variety of laboratory-based research projects, there are no specific actions aimed at alleviating the primary risks that threaten the continued existence of North American green sturgeon in the wild (70 FR 17398).

Other potential conservation measures such as the opening of the RBDD gates have helped North American green sturgeon passage in the Sacramento River during the early part of their spawning season, but it is not known how effective this measure has been. In addition, the fish ladders on RBDD do not allow North American green sturgeon to pass after May 15, when the RBDD gates are closed each year (70 FR 17386). Fish salvaging efforts at the Tracy Fish Collection Facility and the Skinner Delta Fish Protective Facility in the South Delta have been operating for decades, but it is unknown whether efforts to relocate adults have resulted in restoration of spawning potential and whether the salvage of juveniles is effective (70 FR 17398). Other conservation measures targeted at anadromous salmonids, such as improving river thermal and flow regimes, are likely to improve conditions for North American green sturgeon as well (70 FR 17398).

Both white and green sturgeon are protected by the same fishing regulations in the Sacramento-San Joaquin system. No commercial take is permitted and angling take is restricted to one fish per day between 117 and 183 cm TL. An additional closure in central San Francisco Bay occurs between January 1 and March 15, coinciding with the herring spawning season to protect sturgeon feeding on herring eggs (CDFG 2002c). Active sturgeon enforcement often is employed in areas where sturgeon are concentrated and particularly vulnerable to the fishery (70 FR 17397).

The protective efforts described above, when evaluated pursuant to NMFS' *"Policy for Evaluation of Conservation Efforts,"* do not as yet, individually or collectively, provide sufficient certainty of implementation and effectiveness to counter the extinction risk assessment conclusion that the southern DPS of North American green sturgeon is likely to become an endangered species in the foreseeable future throughout its range (70 FR 17398).

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem within the action area (*i.e.*, from 450 feet upstream and 500 feet downstream of the Airport Road bridge) (FWS and NMFS 1998).

A. Status of listed and proposed species and critical habitat within the action area

The action area provides spawning habitat for winter- and spring-run Chinook salmon, steelhead, and North American green sturgeon. The action area also functions as a migratory corridor for adult and juvenile winter- and spring-run Chinook salmon, steelhead and North American green sturgeon, and as juvenile rearing habitat for all of these species. Due to the life history timing of winter- and spring-run Chinook salmon, steelhead and North American green sturgeon, it is possible for one or more of the following life stages: adult migrants, spawners, incubating eggs, or rearing and emigrating juveniles to be present within the action area throughout the year.

1. Status of Species

Reliable estimates of the number of winter- and spring-run Chinook salmon, steelhead and North American green sturgeon adults and juveniles within the action area are not available, however general Chinook salmon redd abundance and spawning distribution for winter-and spring-run Chinook salmon can be determined through DFG aerial redd surveys.

a. *Chinook Salmon*

DFG conducts frequent aerial redd surveys of the upper Sacramento River from the Red Bluff Diversion Dam to Keswick Dam throughout the year. These surveys indicate that the action area is within the primary spawning range of winter- and spring-run Chinook salmon. Records were examined for the area extending approximately one-half mile upstream and to one-half mile downstream of the Airport Road Bridge, for the period from 1992 through 2001. A summary of the data is presented in Table 2. The DFG surveys show that most Chinook salmon spawning in this reach occurs downstream of the bridge. Limited spawning occurs within one-half mile upstream of the bridge, with the Churn Creek Riffle being the most-utilized site.

The DFG surveys are not of sufficient precision or uniform frequency to allow accurate quantification of the number of redds historically observed in the immediate vicinity of the bridge; however, the following general statements can be made. Chinook salmon spawning within one-half mile upstream of the bridge was observed in only five of the 10 years in the study period. Only 4 of the 84 redds observed were within roughly 500 feet of the bridge and all 84 redds were constructed between October 1 and December 31 indicating that they were most likely created by fall-run and late fall-run Chinook salmon (non-listed species). About 512 redds

Table 2
Chinook Salmon Spawning Activity within ½-Mile upstream and downstream of the Airport Road Bridge: 1992-2001

	Jan	Feb	Mar	Apr 1-15	Apr 16-30	May	Jun	Jul	Aug	Sep	Oct 1-15	Oct 16-31	Nov	Dec
2001	1 [a]	1	1	1		4	4	5	2	1	1	1	1	
U/S	0	0	0	0	--	0	0	0	0	0	0	0	0	--
D/S	8	1	16	0	--	7	20	1	0	0	18	5	9	--
2000			1		1	5	5	3	3	1		1	1	1
U/S	--	--	0	--	0	0	0	0	0	0	--	0	0	3
D/S	--	--	0	--	0	0	9	5	0	0	--	3	12	34
1999						4	4	4	3	1	1			1
U/S	--	--	--	--	--	0	0	0	0	0	0	--	--	0
D/S	--	--	--	--	--	0	1	3	0	0	0	--	--	0
1998			1		1	2	5	4	3	3	2		1	
U/S	--	--	0	--	0	0	0	0	0	0	0	--	0	--
D/S	--	--	0	--	0	0	0	0	0	0	1	--	0	--
1997	1					3	3	5	3	4	1		1	1
U/S	0	--	--	--	--	0	0	0	0	0	0	--	40	2
D/S	--	--	--	--	--	0	0	0	0	2	0	--	0	1
1996					1	3	4	5	2	2	1	1	1	
U/S	--	--	--	--	0	0	0	0	0	0	2	16	0	--
D/S	--	--	--	--	0	0	0	0	0	0	2	0	0	--
1995						2	3	4	5	4	1	1	3	
U/S	--	--	--	--	--	0	0	0	0	0	0	0	0	--
D/S	--	--	--	--	--	0	0	1?	0	0	0	4	42	--
1994			1		2	4	5	2	3	2	1	1	3	1
U/S	--	--	0	--	0	0	0	0	0	0	0	0	0	0
D/S	--	--	0	--	0	0	0	0	0	3	43	27	62	--
1993					1	4	4	4	1	1	1	1	2	1
U/S	--	--	--	--	0	0	0	0	0	0	0	2	16	0
D/S	--	--	--	--	0	0	0	0	0	0	--	14	16	5
1992	1			1	1	4	3	2	1	1	1		3	
U/S	0	--	--	0	0	0	0	0	0	0	2	--	1	--
D/S	--	--	--	2	0	--	0	1	0	0	23	--	111	--
Total	3	1	4	2	7	35	40	39	26	20	10	6	16	5
U/S	0	0	0	0	0	0	0	0	0	0	4	18	57	5
D/S	8	1	16	2	0	7	30	11	0	5	87	53	252	40
	[b]LFR	LFR	LFR	LFR	W R	WR	WR	W R	WR/ SR	SR	SR / FR	FR	FR	FR/ LFR

[a] Numbers in red indicate the number of aerial surveys conducted in the indicated time period.
[b] Likely ESUs based on spawn timing - LFR = late fall-run; WR = winter-run; SR = spring-run; FR = fall-run

were recorded within one-half mile downstream of the bridge during the 10-year study period. Only 137 of these redds were within roughly 500 feet downstream of the bridge.

Out of the total of 596 redds recorded within one-half mile up and downstream of the bridge, less than 10 percent (50) were built during the time period when winter-run Chinook salmon would be expected to be spawning, and less than 1 percent (5) were built during the time period exclusive to spring-run spawning (September). One of the DFG biologists who participated in the aerial redd counts stated that most spawning in the vicinity of the bridge occurs in gravels deposited by Clover Creek (Doug Killam, DFG, pers. comm. as reported in Shasta County (2005)). The mouth of Clover Creek is about 200 feet downstream of the bridge.

b. *Steelhead*

Steelhead and/or rainbow trout redds have also been observed within the action area during aerial redd surveys, although these redds have not been counted or documented (Doug Killam, DFG, pers. comm. 2005).

c. *North American green sturgeon*

The current area occupied by North American green sturgeon in the Sacramento River is uncertain. Adult green sturgeon have recently been video documented immediately below RBDD in 2004 (Doug Killam, DFG, pers. comm. 2005). Migrating green sturgeon that get past RBDD before the gates close on May 15 (in most years) face no migration barriers through the action area and upstream to ACID on the north end of Redding. It is therefore reasonable to assume that green sturgeon may occur within the action area. Newly hatched juvenile green sturgeon are captured each summer in the rotary screw traps which sample the water coming out of RBDD (Gaines and Martin 2001) providing firm evidence that spawning occurs upstream of RBDD.

2. <u>Status of Critical Habitat</u>

Riverine habitat within the action area includes the Sacramento River and Clover Creek. The Sacramento River in this area is a large perennial stream that provides all of the PCEs of critical habitat for the three listed salmonids. Extensive gravel deposits suitable for salmonid spawning are present in the immediate vicinity of the bridge. Water temperatures, quantity and quality are generally within suitable ranges to support all life stages of salmonids (with the occasional exception of incubating eggs discussed below). Most of the river banks are lined with healthy riparian communities, with the exception of an old boat launch site on the south side of the river and the area directly under the bridge. The dominant species in the canopy layer of the riparian zone include Fremont cottonwood (*Populus fremontii*), valley oak (*Quercus lobata*), and black locust (*Robinia pseudoacacia*). Sub-canopy trees include white alder (*Alnus rhombifolia*), and Oregon ash (*Fraxinus latifolia*). Understory vegetation includes, lianas of wild grape (*Vitis californica*), dense thickets of California blackberry (*Rubus ursinus*), exotic Himalayan blackberry (*Rubus discolor*), and several species of willow (*Salix spp.*). The forb herbaceous layer consists of rushes (*Juncus* sp.), sedges (*Carex* sp.), and Douglas sagewort (*Artemisia douglasia*).

Clover Creek is an intermittent stream with a gravel/cobble bed that enters the north side of the Sacramento River approximately 200 feet downstream of the Airport Road Bridge. Clover Creek provides the necessary PCEs for juvenile rearing throughout much of the year, particularly at the mouth where cold Sacramento River water mingles with the warmer creek flows. Extensive riparian vegetation is present along its banks on the lower reach, east of Airport Road, but is only sparsely present in the upper reaches west of the road (Figure 2). While Clover Creek is to warm and dry to provide PCEs for winter- and spring-run Chinook salmon spawning, high winter flows may provide the necessary PCEs to support successful spawning of steelhead.

The flows in the upper Sacramento, including the action area, are regulated by releases from Keswick and Shasta Dams. Summer releases are closely managed to meet water temperature objectives to provide the necessary PCEs for spawning winter- and spring-run Chinook salmon. From May through August Keswick releases average approximately 12,000 cfs and water temperatures are held at or below 56 °F. Releases are reduced from September through December and under dry conditions can often drop to between 5,000 and 4,000 cfs. Flow reductions of this magnitude have been found to dewater salmonid redds built along the shallow margins and point bars throughout the upper river (Doug Killam, DFG, pers. comm. 2002). January, February, and March have the greatest probability of high flows, but they can also have some of the lowest flows of the year depending on the amount and timing of precipitation and available storage behind Shasta Dam. In dry years, winter flows in the action area are frequently held below 4,000 cfs and can potentially go as low as 3,250 cfs. Again, if salmonid redds are built under higher flow conditions (either earlier in the year or during weather related flow peaks), large, sustained flow reductions can cause the dewatering of redds built in shallow water.

After water temperatures and flows, the most important PCE for salmonid spawning habitat is appropriate substrate or spawning gravel. Section 3406(b)(13) of the CVPIA requires the Bureau of Reclamation to restore and replenish spawning gravel, and re-establish meander belts in rivers. To meet these requirements in the upper Sacramento River, spawning gravel augmentation projects have placed suitable spawning substrate into various locations in the Sacramento River. Between 1998 and 2005, BOR placed nearly 100,000 tons of clean washed spawning gravel into the river in two locations (below Keswick Dam and at the mouth of Salt Creek). Other construction projects have also compensated for adverse effects to salmonids using spawning gravel augmentation.

A spawning gravel survey was performed by Natural Resource Scientists, Inc., to determine the presence or absence of potential anadromous salmonid spawning habitat within the action area. The survey covered an area 700 feet upstream and 700 feet downstream of the existing Airport Road Bridge. The habitat survey was performed on October 21, 2003, when the water release from Keswick Dam (approximately 18 river miles upstream) was 6,833 cubic feet per second (cfs) and flow at the Bend Bridge gauge (approximately 25 river miles downstream) was 7,430 cfs (California Data Exchange Center 2003). When the survey was conducted, fall-run Chinook salmon were actively spawning and the water was exceptionally clear.

Spawning habitat was classified as good, fair, or poor based on the following characteristics:

> **Good:** Substrate of good to excellent quality because of expected ease in redd construction, expected good structural integrity, and probable high egg survival. Substrate is predominately composed of gravel and cobble with some fines (<20 percent) (primarily sand) present. Substrate sizes range from approximately 1 to 6 inches in particle diameter with a majority in the 1 to 4 inch range. Observed and projected water velocities (within a wide range of flows) within the desirable range for spawning.
>
> **Fair:** Substrate of less-than-optimal quality for redd construction because of probable lower than optimal egg survival. Substrate composed of gravel and cobbles, but with a significantly higher proportion of fines (>20 percent) (primarily sand) present as compared to "good" classification. Observed and projected water velocities adequate for spawning.
>
> **Poor or Absent:** Substrate not meeting the criteria for good or fair. Dominant substrate composed of fine material (>30 percent) (primarily sand). May also be poor habitat based on observed and projected water velocities too low for spawning activities.

Most of the riverbed in the survey area was found to be suitable salmon spawning habitat primarily due to ideal substrate particle sizes and water velocities. The only significant area where suitable PCEs of spawning habitat was not available was located near the upstream survey boundary; that area was dominated by fine particles rendering the substrate poor for spawning.

A total of 67 recently constructed salmon redds (likely constructed by fall-run Chinook salmon due to time of year) were recorded within the survey reach. Fifty-three redds were located downstream of the bridge and 14 redds were located upstream of the bridge. The majority of salmon spawning activity and redds were observed immediately downstream of the Clover Creek confluence with the Sacramento River, on the northeast side of the existing bridge.

In addition to the spawning habitat, the action area provides the necessary PCEs of critical habitat to support excellent rearing conditions for juvenile winter- and spring-run Chinook salmon and steelhead. Pools, riffles, shallow water margins, and near shore brushy riparian vegetation provide the PCEs for juvenile rearing and create slow water refugia, turbulent over head cover, and aquatic insect production.

B. Factors affecting species and critical habitat within the action area

Factors affecting the listed and proposed species and critical habitat within the action area include river flows, water temperatures, spawning gravel suitability, water quality, interactions with other species, and the quality and abundance of riparian habitat. River flow and temperature criteria were established in the 1993 biological opinion for the CVP and State Water Project Operations, Criteria, and Plan, which led to the construction of the Shasta Dam temperature control device, and have resulted in improved temperature management. Although these criteria were developed to meet winter-run Chinook salmon needs, spring-run Chinook salmon, steelhead and North American green sturgeon also have benefited. Gravel augmentation and natural recruitment has resulted in large areas of high quality spawning gravel. Riparian conditions provide limited shade and large woody debris recruitment because the existing riparian habitat is comprised primarily of small diameter brush, and does not form a canopy over the river.

Ongoing improvements to the upper reaches of the Sacramento River including gravel augmentation, screening of diversions and riparian habitat restoration are expected to further improve conditions for anadromous fish and critical habitat, but the incremental benefit of these actions is not yet known. Even with these improvements, some problems persist that may affect anadromous fish and reduce the quality of the PCEs of critical habitat within the action area. Some of the remaining problems include episodic discharges of heavy metals from the Superfund Iron Mountain Mine site, major fall and winter flow reductions causing dewatering of redds, potential competition and genetic introgression between spring- and fall-run Chinook salmon due to overlapping spawning habitats, and degraded rearing conditions in the river due to a lack of mature riparian habitat.

The frequency of acid mine drainage exceeding target levels below Keswick Dam has decreased over the last ten years, however, exceedances of dissolved copper targets have occurred during each of the last six years, and metal concentrations remain high enough to have sublethal effects on adult fish and lethal effects on eggs and larvae (California Regional Water Quality Control Board 2001). Although acid mine drainage has, over the years, reduced the number of Chinook salmon and steelhead within the action area, recent remedial actions at Iron Mountain Mine are thought to have curtailed the direct poisoning of listed species.

Fall flow reductions have been found to negatively impact PCEs for salmonid spawning by causing extensive redd dewatering throughout the Sacramento River spawning areas (Doug Killam, DFG, pers. comm. 2002). The largest reductions have been occurring in early to mid-November, following the peak in water demand for rice decomposition. While reductions in this time period primarily impact fall-run Chinook salmon, they also have the potential to impact late spawning spring-run Chinook salmon and early spawning steelhead.

The construction of Shasta and Keswick Dams, and the resultant exclusion of spring-run Chinook salmon from their historic upper Sacramento River spawning habitat has forced mainstem-spawning spring-run Chinook salmon to spawn in the middle reaches of the river (between Keswick and Red Bluff Dams) in areas easily accessible to fall-run Chinook salmon. Because spring-run Chinook salmon hold over the summer and spawn during a similar time period as do fall-run Chinook salmon (September through October depending on habitat conditions), there is a potential for the two races to have negative interactions such as competition for prime spawning sites, superimposition of redds in the same location and genetic introgression caused by individuals of the different races spawning together and creating crossed progeny.

C. Likelihood of species survival and recovery in the action area

Winter- and spring-run Chinook salmon, steelhead and green sturgeon are expected to continue to utilize the action area as a migratory corridor, and for spawning and rearing. Despite its relatively small size, the value of the action area as a migratory corridor, and its suitability as spawning and rearing habitat, make it an important node of habitat for the survival and recovery of local populations of listed and proposed species. Because the action area is within the most important habitat available to winter-run Chinook salmon, the continuity and connectivity of the action area to the rest of this habitat is important for the survival and recovery of that ESU.

Although the habitat within the action area may be important for the survival and recovery of local populations of spring-run Chinook salmon and steelhead, the distribution of these species throughout the geographical range of the ESU, and their primary abundance in other streams and rivers, means that the value of the habitat within the action area may not be essential for the survival and recovery of spring-run Chinook salmon and steelhead.

The abundance or even occurrence of North American green sturgeon within the action area is undocumented. The information that is available indicates that, as with winter-run Chinook salmon, the mainstem Sacramento River may be the last viable spawning habitat for the southern DPS of North American green sturgeon (NMFS 2003). Because of similarities in their migration and spawn timing, it is likely that many of the same factors affecting winter-run Chinook salmon are also significant to green sturgeon. However, the action area does not appear to provide the preferred spawning habitat for green sturgeon (deep, turbulent pools) as it does for winter-run Chinook salmon, and therefore may be somewhat less important to green sturgeon survival and recovery than it is for winter-run Chinook salmon.

V. EFFECTS OF THE ACTION

Pursuant to Sections 7(a)(2) and 7(a)(4) of the ESA (16 U.S.C. §1536), Federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed or proposed species or result in the destruction or adverse modification of designated or proposed critical habitat. This biological opinion assesses the effects of the Airport Road Bridge Replacement project on Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead and the southern DPS of North American green sturgeon and the critical habitats for the listed salmonids. The Airport Road Bridge Replacement project is likely to adversely affect listed and proposed species through temporary construction impacts and short term critical habitat alteration. In the *Description of the Proposed Action* section of this Opinion, NMFS provided an overview of the action. In the *Status of the Species* and *Environmental Baseline* sections of this Opinion, NMFS provided an overview of the threatened, endangered and proposed species and designated critical habitat that are likely to be adversely affected by the activity under consultation/conference.

Regulations that implement sections 7(b)(2) and 7(a)(4) of the ESA require biological and conference opinions to evaluate the direct and indirect effects of Federal actions and actions that are interrelated with or interdependent to the Federal action to determine if it would be reasonable to expect them to appreciably reduce listed and proposed species' likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (16 U.S.C. §1536; 50 CFR 402.02). Section 7 of the ESA also requires biological opinions to determine if federal actions would cause destruction or adverse modification of critical habitat.

The regulatory definition of adverse modification has been invalidated by the courts. Until a new definition is adopted, NMFS will evaluate destruction or adverse modification of critical habitat by determining if the action reduces the value of critical habitat for the conservation of the species.

NMFS generally approaches "jeopardy" analyses in a series of steps. First, we evaluate the available evidence to identify the direct and indirect physical, chemical, and biotic effects of proposed actions on individual members of listed or proposed species or aspects of the species' environment (these effects include direct, physical harm or injury to individual members of a species; modifications to something in the species' environment - such as reducing a species' prey base, enhancing populations of predators, altering its spawning substrate, altering its ambient temperature regimes; or adding something novel to species' environment - such as introducing exotic competitors or disruptive noises). Once we have identified the effects of an action, we evaluate the available evidence to identify a species' probable response (including behavioral responses) to those effects to determine if those effects could reasonably be expected to reduce a species' reproduction, numbers, or distribution (for example, by changing birth, death, immigration, or emigration rates; increasing the age at which individuals reach sexual maturity; decreasing the age at which individuals stop reproducing; among others). We then use the evidence available to determine if these reductions, if there are any, could reasonably be expected to appreciably reduce a species' likelihood of surviving and recovering in the wild.

A. Approach to the Assessment

1. Information Available for the Assessment

To conduct this assessment, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the status of these species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, government and non-government reports, the biological assessment for this project, and project meeting notes. For information that has been taken directly from published, citable documents, those citations have been referenced in the text and listed at the end of this document.

2. Assumptions Underlying This Assessment

In the absence of definitive data or conclusive evidence, NMFS will make a logical series of assumptions to overcome the limits of the available information. These assumptions will be made using sound scientific reasoning that can be logically derived from the available data. The progression of the reasoning will be stated for each assumption, and supporting evidence will be sited.

B. Assessment

The proposed project includes actions that may adversely affect several life stages of winter-run Chinook salmon, spring-run Chinook salmon, steelhead, and North American green sturgeon.

Adverse effects to these species and their habitat may result from changes in water quality from construction activities, loss of riparian vegetation from construction activities, and damage to incubating eggs and harassment of juvenile and adults from pile driving and gravel pad installation. The project includes integrated design features to avoid and minimize many of these potential impacts.

1. Water Quality

In-river construction and demolition work may increase suspended sediments and elevate turbidity above natural levels. Activities that could contribute sediment and increase turbidity include sheet and steel pile driving and removal, placement and removal of gravel work pads, removal of existing piers, and use of near-river access roads and staging areas. Water quality may also be affected by hydraulic and fuel line leaks and petroleum spills. NMFS expects that the risk of introducing petroleum products or pollutants other than sediment to the waterway will be sufficiently minimized because prevention and contingency measures will require frequent equipment checks to prevent leaks, will keep stockpiled materials away from the water, and will require that absorbent booms are kept onsite to prevent petroleum products from entering the river in the event of a spill or leak.

High turbidity can affect fish by reducing feeding success, causing avoidance of rearing habitats, and disrupting upstream and downstream migration. Displacement of juveniles from preferred habitats may cause increased susceptibility of juveniles to predation. Bisson and Bilby (1982) reported that juvenile coho salmon avoid turbidities exceeding 70 NTUs, and Sigler *et al.* (1984) in Bjornn and Reiser (1991) found that turbidities between 25 and 50 NTUs reduced growth of juvenile coho salmon and steelhead. Turbidity should affect Chinook salmon in much the same way it affects juvenile steelhead and coho salmon because of similar physiological and life history requirements between the species. Increased sediment delivery and high levels of turbidity also can cause infiltration of fine sediment into spawning gravels. This can lead to decreased substrate permeability and intergravel flow, resulting in oxygen depletion and mortality of incubating eggs and pre-emergent fry (Lisle and Eads 1991). Increased sediment delivery can also fill interstitial substrate spaces resulting in reduced abundance and availability of aquatic invertebrates for food (Bjornn and Reiser 1991).

Effects of project-related turbidity and introduction of sediment to the Sacramento River water could affect the behavior, growth, and migration of listed and proposed species in the action area. Adherence to the preventative and contingency measures of the SWPPP will minimize project related-sediment plumes caused by in-river construction by removing excavation materials to locations outside of the river channel and halting work in the event of a plume being detected. Sediment management and preventative measures will minimize the amount of project-related sediment introduced to the waterway through the use of silt fences, straw mulch, erosion control seeding, and clean, washed work pad materials. In the event that a project-related sediment plume does occur, it would be of short duration, since work would be suspended, and would be expected to result in a temporary change in the distribution of fish in the action area, lasting only as long as the plume was present.

These types of events are unlikely to affect migrating adults to the extent of injuring them, but may injure some juvenile fish, which are actively feeding and growing, as well as smaller and less mobile, by temporarily disrupting normal behaviors that are essential to growth and survival. Injury would be caused when disruption of these behaviors increases the likelihood that individual fish will face increased competition for food and space, and experience reduced growth rates or possibly weight loss. Project-related turbidity increases may also affect the sheltering abilities of some juvenile fish and may decrease their likelihood of survival by increasing their susceptibility to predation. However, because of the short duration of the turbidity events, the injury and death that may occur to listed and proposed species from changes in feeding behavior, distribution and predation, are not expected to result in appreciable reductions in the species' likelihood of surviving and recovering in the wild.

2. Riparian Habitat

Riparian vegetation adjacent to the river, including SRA habitat, is a PCE of critical habitat for winter-run Chinook salmon. Riparian habitat is an important element of critical habitat because it provides cover, shelter, shade, and contributes to food production (Platts 1991).

Construction activities associated with the proposed Airport Road Bridge Replacement project would result in adverse impacts to this PCE of critical habitat. Up to 1.2 acres of riparian vegetation and SRA habitat would be disturbed as a result of construction activities. The majority of these impacts are expected to be temporary, as all disturbed areas outside the actual footprint of the new bridge would be replanted and restored with native riparian vegetation. In addition, the new bridge will provide a net gain of approximately 0.5 acres of shade over the Sacramento River and Clover Creek.

Removal of riparian habitat will affect winter- and spring-run Chinook salmon, steelhead and green sturgeon by reducing the amount of overhanging and submerged vegetation, and consequently the amount of cover available for fish, and the food supply provided when terrestrial insects fall into the river from overhanging vegetation. Removal of riparian vegetation is not expected to affect water temperature because the extent of shade to be lost is not sufficient to influence the effects of water temperature controlled through cold water releases from Shasta Reservoir.

The project has been designed to avoid and minimize losses to riparian vegetation adjacent to the river channel. Mature cottonwood trees located near construction areas will be flagged and avoided during construction to the fullest extent possible. In addition, exclusionary fencing shall be installed within all riparian areas in which construction access would have to occur to ensure that impacts to riparian vegetation are minimized. When loss of riparian vegetation along the river is unavoidable, Shasta County will restore riparian vegetation at a ratio of 3:1 for each woody riparian plant and/or linear foot of SRA habitat removed due to project construction (either temporary construction access or permanent loss associated with new piers).

Shasta County has developed a riparian revegetation plan to address impacts to SRA habitat that occur during project construction. The revegetation plan identifies appropriate compensation for impacts, describes planting techniques and locations, and incorporates planting of native species that would resist invasion of noxious plant species. Impacts to riparian habitat would be compensated on site to the greatest extent possible, within the areas disturbed as a result of construction activities (*i.e.*, construction access routes, materials staging, etc.). If the required amount (3:1) of riparian habitat restoration can only be partially achieved onsite, the remaining balance shall be fulfilled by purchasing mitigation credits at the California Department of Fish and Game's Battle Creek Mitigation Bank.

The impacts to riparian vegetation are expected to affect critical habitat and the species utilizing the action area for 10 to 20 years following construction, or until the vegetation conditions can become re-established. Willows and low shrubs will revegetate most quickly and may contribute to fish habitat in fewer than ten years; however, the larger trees such as cottonwoods and oaks that contribute the large woody component of SRA may take more than 20 years to be replaced. Since the area is dominated by shrubs and willows, and large trees will be avoided to the greatest extent possible, most of the existing habitat features should be maintained or replaced within ten years. Juvenile fish utilizing the action area during this recovery period could be injured from the reduced levels of overhead cover and food supply, and increased exposure to predators. Because of the small size of the affected area, the limited term of the expected impacts, the abundance of other forms of overhead cover and shade (*e.g.*, pools, riffles and the bridge itself), and adequate aquatic food production, it is unlikely that the expected reduction in riparian habitat values will appreciably reduce the listed and proposed species' likelihood of surviving and recovering in the wild.

3. <u>Impacts to Spawning Habitat PCEs</u>

Based on the October 21, 2003, salmonid spawning habitat assessment, The PCEs that make up suitable spawning habitat were present throughout most of the in-river area that will be physically disturbed due to the bridge replacement activities. Gravel work pad installation will be the most significant cause of temporary reductions in the amount and quality of available spawning habitat, either through the direct covering of spawning substrate or through modification of flow patterns and current velocities which may reduce the suitability of spawning habitat for an undetermined distance above and below the work pads. In addition, small areas enclosed by cofferdams and occupied by trestle piles also will be temporarily unavailable as spawning habitat.

The proposed bridge replacement would result in only two piers being located within the river, as opposed to the four piers in the river on the existing bridge structure. This may result in a long term beneficial impact by creating new areas in which suitable spawning substrates could become established. Additionally, there may be a net improvement in the PCEs that make up spawning habitat as a result of project implementation since the clean gravel used to construct the work pads will be left in the river channel (subject to approval from the Reclamation Board), and allowed to wash downstream and replenish spawning areas.

A 1980 survey of spawning sites available between Keswick Dam and Red Bluff Dam, indicated that there were approximately 96,000 sites available (DFG 2001b). Based on the large number of potential spawning sites and the relatively small number of returning winter-run Chinook salmon at this time (the most abundant of the three listed salmonids in this area, generally between 7,000 and 15,000 adults over the last 5 years; Table 1), the short-term loss of this small amount of potential spawning habitat is not expected to significantly impact spawning salmonids or appreciably reduce the reproductive success of winter- or spring-run Chinook salmon or steelhead.

4. Pile Driving and Bridge Demolition

Pile driving consists of driving steel pile columns and sheets into the riverbed with a mechanical hammer. The force of the hammer hitting a pile forms a sound wave that travels down the pile and causes the pile to resonate radially and longitudinally. Acoustic energy is formed as the walls of the steel pile expand and contract, forming a compression wave that moves through the pile. The outward movement of the pile wall sends a pressure wave propagating outward from the pile and through the riverbed and water column in all directions.

Because inconsistent mediums, such as water, will result in a higher rate of transmission loss, environmental factors such as water depth, water turbulence, air bubbles, and substrate consistency are important to consider when estimating the distance a compression wave will travel. A compression wave traveling through shallow water and substrates with variable consistencies (*i.e.*, variable particle size class distribution) will attenuate more rapidly than compression waves traveling through a constant medium such as deep water or bedrock. As a compression wave moves away from the source, the wave length increases and intersects with the air/water interface. Once the compression wave contacts the air, it attenuates rapidly and does not return to the water column.

In planning for the replacement of the Cypress Avenue Bridge in Redding, California, Caltrans engineers estimated that sound pressure from driving the largest bridge piles could reach as high as 180 dB at the source (*i.e.*, the pile being driven). Due to similarities in construction techniques, as well as river and substrate conditions between the Airport Road Bridge and the Cypress Avenue Bridge, sound effects from pile driving are expected to be similar at the two sites. Demolition of the existing bridge piers will require the use of a hoe-ram to break up the concrete into manageable pieces for removal. While sound energy will be created during this process in much the same way as is described above for pile driving, the energy generated by the hoe-ram typically is much less than the energy generated by a pile-driving hammer by a factor of 10. For instance, the driving energy for a steel pile driver is approximately 75,000 ft-lbs, while the hoe-ram delivers around 7,500 ft-lbs of energy. The sound energy created by the hoe-ram during removal of the old bridge is not expected to exceed that of normal underwater background levels (60 to 65 dB) and is therefore not expected to adversely impact listed or proposed species.

a. *Pile Driving Effects on Incubating Eggs*

Salmon and steelhead eggs are very fragile and thus susceptible to mechanical shock prior to the eyed egg stage (Jensen and Alderice 1983, Piper *et al.* 1982). Chinook salmon eggs generally reach the eyed stage within 19 days of fertilization under typical fall water temperatures of 56°F in the action area (Piper *et al.* 1982). Steelhead eggs generally reach the eyed stage within 12 days of fertilization under typical winter water temperatures of 48°F in the action area (Velson 1987). During this period of early development, high pressure compression shock waves may cause egg mortality in redds that are close to pile driving activities. In planning for the replacement of the Diestelhorst Bridge in Redding California, engineering analysis concluded that driving small piles would be likely to kill pre-eyed salmon and steelhead eggs located up to 150 feet from the pile, and large "H" pile driving would be likely to kill pre-eyed eggs located up to 450 feet away from the sound pressure source (Harry Rectenwald, DFG, pers. comm. 2002). In order to determine these distances at Diestelhorst, Caltrans engineers used the static and oscillating pressure thresholds for salmon eggs identified by Sutherland and Ogle (1975). These thresholds were initially recognized through evaluating the effects of jet boats on salmon eggs, and were considered applicable for evaluating the effects of pile driving because they are based on sound pressure.

Pile driving activities are scheduled to occur between October 15 and April 15, for two consecutive years. This pile driving work-window falls outside of the primary spawning and incubation seasons for winter-run Chinook salmon, spring-run Chinook salmon, and North American green sturgeon. Because pile driving has the potential to occur throughout much of the steelhead spawning and incubation period (December through May), steelhead eggs are the most likely to be impacted by pile driving. There also is a potential for the eggs of late-spawning spring-run Chinook salmon to be affected (*i.e.*, eggs fertilized after September 26) during the first year of construction. In the second year of construction, only small sheet-piles are expected to be driven to form cofferdams around the old bridge piers for removal, and that activity is not scheduled to begin until mid-January (Shasta County 2005), well after the spring-run Chinook salmon incubation period.

With regards to spring-run Chinook salmon, the percent of the total Central Valley ESU that spawn in the mainstem Sacramento River is very low (*i.e.*, average of 2.6 percent over the past 5 years; CDFG 2004b), and the area to be affected by pile driving is a small proportion of the total suitable spawning area within the mainstem Sacramento River (*i.e.*, 900 feet out of a total of 35 miles or 0.5 percent of total area). In addition, over half of spring-run Chinook salmon would be expected to spawn before September 26 (Vogel and Marine 1991), and therefore be past the eye-up stage when pile driving starts on October 15. By combining these figures, the total percentage of Central Valley spring-run Chinook salmon eggs that would be expected to be killed by pile driving during the first year of the proposed project would be 0.0065 percent. Additionally, salmonid eggs, larvae, and juveniles are naturally vulnerable life stages and typically face a high likelihood of mortality (*e.g.* 80 percent or greater from spawning to the fry/smolt stage (Healey 1991)). The loss of such a small additional percentage of eggs or larvae is not likely to detectably influence the number of adults returning to spawn in the resulting year class. Therefore, any potential pile driving impacts to incubating spring-run Chinook salmon eggs are not expected to be of a magnitude that would appreciably reduce the likelihood of survival and recovery of this species.

Due to the lack of population data on Central Valley steelhead, it is more difficult to estimate the percentages of steelhead eggs that may be impacted by the proposed pile driving activities. There have been no studies to determine the percentage of Central Valley steelhead that spawn in the Sacramento River. However, there are several factors that can be examined in developing an estimation of the level of impacts that pile driving is likely to have on incubating steelhead eggs.

1. Steelhead are generally more likely to spawn in upper headwaters and smaller tributary streams than in large mainstem rivers like the Sacramento. There are several documented populations in tributaries such as Battle, Deer, Mill, and Butte Creeks as well as the Yuba, American and Feather Rivers. It is therefore reasonable to assume that a significant proportion of the Central Valley steelhead ESU does not spawn in the mainstem Sacramento River.

2. Cold winter water temperatures create a large area of the Sacramento River with water temperatures that are suitable for salmonid spawning during the primary steelhead spawning season (approximately 60 miles from Keswick Dam to Red Bluff Diversion Dam). The 900 foot section of the action area within which steelhead eggs might be impacted amounts to only 0.28 percent of this total area.

3. The construction of gravel work pads adjacent to pile driving areas is expected to render a significant proportion of the impact zone unsuitable for spawning, either through directly covering the area or through modification of flow patterns and current velocities which may reduce the suitability of spawning habitat for an undetermined distance above and below the work pads.

4. Pile driving activities are not expected to occur throughout the entire allowable work window. A tentative construction schedule (Shasta County 2005) for the first winter calls for 20 days of small sheet-pile driving from October 30, 2006, through November 24, 2006; 15 days of large, H-pile driving (to construct the new bridge piers) from December 11, 2006 through December 29, 2006; and 40 days of large, H-pile driving (to construct the work trestle) from January 22, 2007 through March 16, 2007. During the second winter's percussive work window, only small sheet piles will be driven to create cofferdams around the old bridge piers for pier removal. Sheet piles are scheduled to be driven for 10 days from January 14, 2008, through January 25, 2008, and for 10 additional days from February 18, 2008 through February 29, 2008. Only those steelhead eggs that are laid within 450 feet of large piles and 150 feet of sheet piles, and are fertilized within 12 days of pile driving activities are likely to be impacted.

Given this information, it is reasonable to assume that a very small fraction of the total egg production for the Central Valley steelhead ESU will be affected by the proposed pile driving activities and that the resulting loss of reproductive potential will not be of a magnitude that would appreciably reduce the likelihood of survival and recovery of this species.

b. *Immediate Mortality of Fish from Pile Driving*

The effect of pile driving on free swimming fish depends on the duration, frequency (Hz), and pressure (dB) of the compression wave. Rassmusen (1967) found that immediate mortality of juvenile salmonids may occur at sound pressure levels exceeding 204 dB. Due to their size, adult salmon steelhead and green sturgeon can tolerate higher pressure levels and immediate mortality rates for adults are expected to be less than those experienced by juveniles (Hubbs and Rechnitzer 1952). As sound pressure levels are not expected to exceed 180 dB, no immediate mortality of juvenile or adult fish is expected.

c. *Pile Driving Impacts on the Auditory Sensory Organs of Fish*

High levels of underwater acoustic noises have been shown to have adverse impacts upon the auditory sensory organs of fish within close proximity of the noise source. Recent studies by Scholik and Yan (2002) examined the effects of boat engine noise on the auditory sensitivity of the fathead minnow. Fish were exposed to a recording of the noise generated by a 55 hp outboard motor over a period of two hours. The noise level was adjusted to 142 dB, which was equivalent to the noise levels measured at 50 meters from a 70 hp outboard motor. The experimental fish suffered a drop in hearing sensitivity over the range of frequencies normally associated with their hearing capabilities. These responses were measured using electrophysiological responses of their auditory nerves under general anesthesia. Studies by McCauley *et al.* (2003) on the marine pink snapper, indicated that high-energy noise sources (approximately 180 dB maximum) can damage the inner ears of aquatic vertebrates by ablating the sensory hairs on their inner ear epithelial tissue as revealed by electron microscopy. Damage remained apparent in fish held up to 58 days after exposure to the intense sound. Although no studies utilizing salmonids have been conducted, auditory effects on these other fish species can serve as surrogates for salmonids, and it is reasonable to assume that some level of adverse impacts to salmonids can be inferred from the above results.

The loss of hearing sensitivity may adversely affect a salmonid's ability to orient itself (*i.e.*, due to vestibular damage), detect predators, locate prey, or sense their acoustic environment. Chronic noise exposure can reduce a fish's ability to detect piscine predators either by reducing the sensitivity of the auditory response or by masking the noise of an approaching predator. Disruption of the exposed fish's ability to maintain position or swim with the school will enhance its potential as a target for predators. Unusual behavior or swimming characteristics single out an individual fish and allow a predator to focus its attack upon that fish more effectively.

d. *Behavioral Responses to Pile Driving*

Behavioral responses to high noise levels (startle response, avoidance, agitation, etc.) have been studied in salmonids with mixed results. Burner and Moore (1962) found that large juvenile and adult fish rarely responded to sudden or loud sound stimuli. Studies of low frequency sound transducers intended to repel salmonids from navigation channels (Goetz *et al.* 2001; Ploskey and Johnson 2001) found no difference between the reactions of treatment groups of Chinook and coho (*O. kisutch*) salmon exposed to no sound and groups exposed to sounds reaching 170-180 dB.

Other experiments by Mckinley and Patrick (1986) using pulsed sound similar to pile driving found that smaller juvenile salmonids demonstrated a startle or avoidance response. Feist *et al.* (1992) found that salmonids hear within a range of 10 to 400 Hz, with the greatest sensitivity between 180 and 190 Hz, and that pile-driving in Puget Sound created sound within the range of salmonid hearing that could be detected at least 600 m away. Abundance of juvenile salmon near pile driving rigs was reduced on days when the rigs were operating compared to non-operating days. Also, Shin (1995) found that pile driving may result in "agitation" of salmonids as indicated by a change in swimming behavior. These studies suggest that pile driving may cause startling and/or avoidance of habitat by fish in the immediate vicinity of the project site.

The startling of fish can cause injury by temporarily disrupting normal behaviors that are essential to growth and survival such as feeding, sheltering, and migrating. Injury is caused when disrupting these behaviors increases the likelihood that individual fish will face increased competition for food and space, and experience reduced growth rates or possibly weight loss. Disruption of these behaviors may also result in the death of some individuals due to increased predation if fish are disoriented or concentrated in areas with high predator densities. Disruption of these behaviors may occur for specific periods between October 15 and April 15 of each construction year, during daylight operation hours of the pile driving hammer. Downstream movement of fry occurs mainly at night, although small numbers of Chinook salmon fry move during daylight hours (Reimers 1973). Because of this nocturnal migratory behavior, daily migration delays are expected only to impact the portion of each ESU that migrates during daylight hours in the periods that pile driving activities are occurring. On similar bridge projects, such as the replacement of the I-5 bridge over the Sacramento River near Anderson, lapses in pile driving activity are common throughout the day because construction crews suspend hammer work for equipment maintenance, to shift from one pile to another, and to take breaks (D. Whitley, Caltrans, pers. comm., 2002). These construction lapses, including daily breaks and nighttime non-working periods, as well as long periods when no pile driving is scheduled to occur, will allow fish to migrate through the action area and minimize the extent of injury that occurs to populations.

The population-level effects of harassment to adult and juvenile Chinook salmon, steelhead and green sturgeon are expected to be limited in part because pile driving will occur during the day, enabling unhindered fish passage at night. Also, the October 15 through April 15 percussive work window will avoid the primary spawning periods for winter and spring-run Chinook salmon and green sturgeon, as well as the primary outmigration period for juvenile winter-run Chinook salmon (July through October) and green sturgeon (June through September). Additionally, many subpopulations of Central Valley spring-run Chinook salmon and Central Valley steelhead occur in tributaries downstream of the action area (*e.g.*, Battle, Cottonwood, Deer, Mill, and Butte Creeks) and therefore are not expected to be affected by the proposed project at all.

5. Cofferdams

Closure of cofferdams (during November 2006, and January/February 2008) may entrap winter-run Chinook salmon, spring-run Chinook salmon, steelhead and green sturgeon. The cofferdam installation process probably will startle most of the salmon near the construction site and cause them to leave the immediate area of work; however it is possible that some fish will be entrained when the coffer is closed. Conducting a fish salvage operation in closed cofferdams will reduce the potential mortality associated with entrapment and subsequent pumping-out of the dammed area. Any fish recovered from a cofferdam would be relocated to the stream channel outside of the cofferdam. A small mortality rate (expected to be less than 10 percent if consistent with the results of fish handling in similar fish salvage efforts) is expected from capturing and handling.

6. Fish Passage

The combination of cofferdams and the gravel work pads occupying space in the river will reduce the width of the river and increase water velocities. An increase in water velocities will not prevent juveniles from passing downstream to rear, but has the potential to hinder the upstream migration of adult salmon and green sturgeon. The project has been designed to maintain at least 200 feet of unconfined river flow through the project area. At the I-5 Bridge Replacement project near the City of Anderson, the gravel work pad and cofferdams constricted the channel width to approximately 100 feet. This constriction apparently did not result in velocities capable of preventing the upstream migration of adult salmon and steelhead because in 2001, 98.8 percent of winter-run Chinook salmon and 68.6 percent of fall-run Chinook salmon spawned upstream of the I-5 Bridge Replacement project. These spawning distributions are similar to previous years, prior to the construction period. Because construction techniques at the Airport Road Bridge will maintain a greater width of unconfined channel, and are expected to result in similar or less restrictive flow conditions as those found at the I-5 Bridge, no effects to fish passage, other than the potential delays related to avoidance of pile driving and other sounds (discussed above) are anticipated.

VI. CUMULATIVE EFFECTS

For purposes of the ESA, cumulative effects are defined as the effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within an action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions are not included here because they require separate consultation pursuant to section 7 of the ESA.

Non-federal actions that may affect the action area include population changes and urbanization and habitat restoration. During the period of 1980 to 1990 the population of Redding (11 miles upstream of the project area) increased by 27 percent, and from 1990 to 2000 increased by 11 percent. For the next 25 years, the projected population of the Redding area is expected to increase by 29.9 percent. Increased development is expected to occur concurrent with Redding's population expansion. Population growth and urbanization may adversely affect water quality in the action area as the amount of impervious surface area increases, resulting in peaking hydrographs of contaminated urban runoff.

It is difficult to predict what effect these actions will have on listed salmonids. Habitat restoration probably will continue to improve conditions for salmonids by increasing their range, distribution, and natural production; however the effectiveness of restoration in offsetting the adverse effects related to urban growth are not fully known.

VII. INTEGRATION AND SYNTHESIS OF EFFECTS

Populations of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead and the southern DPS of North American green sturgeon have declined drastically over the last century. They have been cut off from much of their historic spawning grounds by impassible dams and endured a general degradation of the remaining accessible habitat below those dams. Winter-run Chinook salmon and the southern DPS of North American green sturgeon are thought to be limited to single spawning populations in the mainstem Sacramento River. The current status of listed salmonids, based upon their risk of extinction, has not significantly improved since the ESUs were listed (Good *et al.* 2005).

Under the proposed Airport Road Bridge Replacement project, adverse impacts to listed and proposed species stemming from loss of riparian vegetation, increased sedimentation, and periods of high turbidity are expected to occur. These impacts may cause physiological stress to the extent that the normal behavior patterns (*e.g.*, feeding, sheltering and migration) of affected individuals may be disrupted. Potential impacts are expected to be minimized by meeting Regional Water Quality Control Board water quality objectives, Caltrans water pollution specifications, implementing "best management practices" for erosion control, staging equipment outside of the riparian corridor, limiting the amount of riparian vegetation removal, and restoring lost riparian habitat values at the project site or at the Battle Creek mitigation site.

A temporary reduction in the amount and quality of spawning habitat in the immediate vicinity of the construction site will occur over a two year period. The PCEs necessary to support successful spawning will be impacted by the placement of gravel work pads in the river channel, either through the direct covering of spawning substrate or through modification of flow patterns and current velocities which will reduce the suitability of spawning habitat for an undetermined distance above and below the work pads. In addition, small areas enclosed by cofferdams and occupied by trestle piles will also be temporarily unavailable as spawning habitat. Over the long term, the amount and quality of spawning habitat PCEs are expected to be slightly improved over the baseline conditions due to the fact that clean gravel used to construct the work pads will be left in the river channel (subject to approval from the Reclamation Board), and allowed to wash downstream and replenish spawning areas, and only two of the new bridge piers will be located within the river, as opposed to the four piers in the river on the existing bridge.

Salmon and steelhead eggs are very fragile and thus susceptible to mechanical shock prior to the eyed egg stage (Jensen and Alderice 1983, Piper *et al.* 1982). Caltrans engineers estimate that sound pressure from driving large bridge piles could reach as high as 180 dB at the source. Engineering analysis indicate that driving small piles is likely to kill pre-eyed salmon and steelhead eggs for up to 150 feet from the pile, and large "H" pile driving is likely to kill pre-eyed eggs for up to 450 feet away from the pile.

Pile driving activities are scheduled to occur between October 15 and April 15, for two consecutive years. This pile driving work-window falls outside of the primary spawning and incubation seasons for winter-run Chinook salmon, spring-run Chinook salmon, and North American green sturgeon. Because pile driving has the potential to occur throughout much of the steelhead spawning and incubation period (December through May), steelhead eggs are the most likely to be impacted by pile driving. There is also a potential for the eggs of late-spawning spring-run Chinook salmon (*i.e.*, eggs fertilized after September 26) to be affected during the first year of construction. In the second year of construction, only small sheet-piles are expected to be driven (to form cofferdams around the old bridge piers for removal) and that activity is not scheduled to begin until mid January (Shasta County 2005), well after the spring-run Chinook salmon incubation period.

The total percentage of Central Valley spring-run Chinook salmon eggs that would be expected to be killed by pile driving would be 0.0065 percent during the first year of the proposed project and no mortality is expected in the second year. Due to the lack of population data on Central Valley steelhead, it is more difficult to estimate the percentages of steelhead eggs that may be impacted by the proposed pile driving activities. Several factors are expected to moderate the potential impacts on steelhead eggs, including:

- The majority of steelhead spawn in smaller tributary streams and are less likely to spawn in the mainstem Sacramento River.
- Steelhead spawning that does occur in the Sacramento River can be spread out over a large area due to cold water temperatures, and the project impact area makes up only 0.28 percent of this total suitable area.
- The construction of gravel work pads adjacent to pile driving areas is expected to render a significant proportion of the impact zone unsuitable for spawning.
- Pile driving activities are not expected to occur throughout the entire allowable work window, and only those steelhead eggs that are laid within 450 feet of large piles and 150 feet of sheet piles, and are fertilized within 12 days of pile driving activities are likely to be impacted.

Given this information, it is reasonable to assume that a very small fraction of the total egg production for Central Valley spring-run Chinook salmon and Central Valley steelhead will be exposed to, and therefore affected by, the proposed pile driving activities and that the resulting loss of reproductive potential will not be of a magnitude that would appreciably reduce the likelihood of survival and recovery of these species.

The elevated noise levels around the pile driving activities may cause temporary behavioral changes and/or loss or reduction of hearing in affected fish. These impacts will be partially mitigated by the seasonal use of the equipment which will avoid the primary migration periods of juvenile winter-run Chinook salmon and North American green sturgeon and the primary adult migration periods of spring-run Chinook salmon and North American green sturgeon. Migrating salmonids may avoid the elevated noise of the pile driving operations by swimming around the area with the highest noise levels or holding outside of the high noise areas until there is a break in the pile driving actions. There is a potential for these fish to suffer a temporary loss of hearing sensitivity at the expected noise levels generated by the pile drivers. Loss of hearing sensitivities in the listed and proposed fish will expose them to higher risks of predation. Fish with impacted hearing capacities will have a lower ability to detect predators and may be unable to maintain position in the water column (inner ear equilibrium factors).

Noise from pile driving may also cause startling and/or avoidance of habitat by fish in the immediate vicinity of the project site. The startling of fish can cause injury by temporarily disrupting normal behaviors that are essential to growth and survival such as feeding, sheltering, and migrating. Disruption of these behaviors may occur for specific periods between October 15 and April 15 of each construction year, during daylight operation hours of the pile driving hammer. Construction lapses, including daily breaks and nighttime non-working periods, as well as long periods when no pile driving is scheduled to occur, will allow fish to migrate through the action area and minimize the extent of impacts to populations.

Some juvenile anadromous fish may be entrained into cofferdams when they are closed. Those fish which are entrained within these cofferdams would have a high probability (> 90 percent) of survival due to planned fish salvage efforts.

A. Impacts of the Proposed Action on Critical Habitat

Critical habitat will be adversely affected by impacts to PCEs such as riparian vegetation and spawning habitat. Up to 1.2 acres of riparian vegetation and SRA habitat would be disturbed as a result of construction activities as well as temporary occupation of the riverbed and water column by cofferdams, work trestles and gravel work pads. The majority of these impacts are expected to be temporary, as all disturbed areas outside the actual footprint of the new bridge would be replanted with native riparian vegetation or restored to the natural riverine habitat conditions. Additionally, implementation of the proposed project would result in a permanent net increase of riverine habitat since this project would result in fewer piers being located within the floodplain.

The temporary impacts to riparian vegetation at the project site are expected to last for approximately 10 to 20 years. Revegetating the project site along with any additional offsite restoration that is necessary will quickly offset the adverse effects of removing annual plants; however, habitat attributes related to the replacement of large woody vegetation will not be realized until much later. Construction of the gravel work pads will affect critical habitat by covering and altering the hydrology of suitable spawning habitat for 2 years, but the remaining gravel will ultimately improve spawning within the action area following the construction period as gravel which is left in the river is redistributed and made available to spawning fish.

These effects to the PCEs of critical habitat may result in a temporary redistribution of some individuals, primarily spawning adult, and rearing juvenile winter- and spring-run Chinook salmon and steelhead; however, due to the temporary nature of these effects, the long-term improvement expected from revegetating the project site, and the expected increase in the amount of spawning gravel in the action area, the adverse effects that are anticipated to result from the proposed project are not of the type, duration, or magnitude that would be expected to adversely modify critical habitat to the extent that it could lead to an appreciable reduction in the function and conservation role of the affected habitat. NMFS expects that nearly all of the adverse effects to critical habitat from this project will be of a short-term nature (aside from some longer-term effects on woody riparian vegetation) and will not affect future generations of listed fish beyond the construction period of the project (two years).

B. Impacts of the proposed action on ESU and DPS survival and potential for recovery

The adverse effects to winter-run Chinook salmon, spring-run Chinook salmon, steelhead and North American green sturgeon within the action area are not expected to affect the overall survival and recovery of the ESUs and DPS. This is largely due to the fact that the construction related impacts will be temporary and will not impede adult fish from reaching upstream spawning and holding habitat, or juvenile fish from migrating to downstream rearing areas. Additionally, egg mortalities from pile driving will be minimized by avoiding the primary spawning and incubation periods for three of the four species and by taking measures to temporarily discourage salmonid spawning in the action area. The project also will compensate for temporary losses of riparian vegetation, and spawning habitat in the action area ultimately will be improved through the introduction of clean, spawning gravel. The bridge replacement design will result in a smaller area of river-bed occupied by the bridge footprint and therefore provide a greater amount of habitat available to listed and proposed species than is currently available with the existing bridge. Overall, the adverse effects that are anticipated to result from the proposed project are not of the type, duration, or magnitude that would be expected to appreciably reduce the likelihood of survival and recovery of the affected species within the action area.

VIII. CONCLUSION

After reviewing the best scientific and commercial data available, including the environmental baseline, the effects of the proposed project, and the cumulative effects, it is NMFS' biological opinion that the Airport Road Bridge Replacement project is not likely to jeopardize the continued existence of endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, and threatened Central Valley steelhead, and is not likely to destroy or adversely modify the designated critical habitat of the above species.

After reviewing the best scientific and commercial data available, including the environmental baseline, the effects of the proposed project, and the cumulative effects, it is NMFS' conference opinion that the proposed Airport Road Bridge Replacement project is not likely to jeopardize the continued existence of the southern DPS of North American green sturgeon.

IX. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Because the measures described below are necessary to minimize the take of listed salmonids, they are nondiscretionary and must be implemented upon issuance of this biological opinion. The measures must be undertaken by FHWA and Caltrans so that they become binding conditions of any grant or permit, as appropriate, for the exemption in section 7(o)(2) to apply. FHWA has a continuing duty to regulate the activity covered by this Incidental Take Statement. If FHWA (1) fails to assume and implement the terms and conditions of the Incidental Take Statement or (2) fails to require Caltrans and Shasta County to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Caltrans or Shasta County must report the progress of the action and its impact on the species to the NMFS as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

While the measures described below are expected and intended to also minimize the potential for take of North American green sturgeon, the prohibitions against taking of listed species in section 9 of the ESA do not apply to proposed North American green sturgeon unless and until the species is listed. However, NMFS advises FERC to consider implementing the following reasonable and prudent measures for proposed North American green sturgeon. If this conference opinion for North American green sturgeon is adopted as a biological opinion following a listing, these measures, with their implementing terms and conditions will be nondiscretionary for North American green sturgeon.

A. Amount or Extent of Take

NMFS anticipates that the proposed action will result in incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead and North American green sturgeon. Incidental take associated with this action is expected to be in the form of harm or harassment of adult winter- and spring-run Chinook salmon, steelhead and green sturgeon resulting from pile driving and temporary loss of riparian and SRA habitat. Juvenile winter- and spring-run Chinook salmon, steelhead and green sturgeon are also expected to be exposed to harm and harassment resulting from pile driving, cofferdam installation, placement of gravel work pads, fish salvage, and temporary loss of riparian and SRA habitat. Mortality of all pre-eyed eggs present in redds constructed within 150 feet of the driving of small sheet-piles and within 450 feet of the driving of large H-piles also is expected. Some mortality (< 10 percent of all fish collected) is anticipated from conducting fish salvage within cofferdams.

NMFS cannot, using the best available information, quantify the anticipated incidental take of individual winter- and spring-run Chinook salmon and steelhead because of the variability and uncertainty associated with the population size of each species, annual variations in the timing of migration, and uncertainties regarding individual habitat use within the project area. However, it is possible to describe the conditions that will lead to the take. Specifically, take during the two-year project is not expected to exceed that associated with:

- 55 to 60 days of large H-pile driving and 20 to 25 days of small sheet pile driving in the first year of construction;
- 20 to 25 days of small sheet pile driving in the second year of construction;

- Fish salvage activities following the construction of each cofferdam that will kill up to ten percent of all fish captured;
- Increased sediment and turbidity, not to exceed Water Quality Control Board standards for the Central Valley basin, from the installation and removal of work trestles, gravel work pads and cofferdams, and;
- The temporary loss of 1.2 acres of riparian vegetation and SRA habitat.

Noise levels from pile driving activities is expected to remain at or below 180 dB, and is expected to startle adults and juveniles in a 600 m radius from the pile driving source, and kill pre-eyed eggs in redds within 150 feet of the driving of small sheet-piles and within 450 feet of the driving of large H-piles.

Permitted incidental take may be exceeded if project activities exceed the criteria described above, if the project is not implemented as described in the biological assessment for the Airport Road Bridge Replacement project, or if the proposed conservation measures listed in the *Description of the Proposed Action* section are not fully implemented.

B. Reasonable and Prudent Measures

NMFS has determined that the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the incidental take of listed anadromous salmonids and proposed threatened North American green sturgeon.

1. Measures shall be taken to minimize the amount and duration of pile driving and its potential impacts on listed and proposed species.

2. Gravel work pads shall be constructed and managed so as to minimize potential adverse impacts, and to maximize potential benefits, to listed and proposed species from these structures.

3. FHWA/Caltrans shall provide a yearly report summarizing construction activities, species status within 200 yards upstream and downstream of the bridge site, avoidance and/or minimization measures taken, and any observed take of listed or proposed species.

C. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, FERC and the applicant must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. Measures shall be taken to minimize the amount and duration of pile driving and its potential impacts on listed salmonids.

a. All trestle, falsework, and cofferdam piles shall be located and constructed so that, wherever feasible, piles shall be left in place and reused in subsequent stages of the construction process.

b. FHWA and Caltrans shall conduct acoustic monitoring within the water column and the substrate of the Sacramento River to determine the range and magnitude of compression shock waves generated by pile driving operations at the Airport Road Bridge Replacement project. Acoustic monitoring must be designed to detect if, and at what range, pile driving activities generate noise levels found to be lethal to juvenile salmonids (204 dB).

2. Gravel work pads shall be constructed and managed so as to minimize potential adverse impacts, and to maximize potential benefits, to listed salmonids from these structures.

   a. In order to avoid the potential for covering/smothering incubating and pre-emergent steelhead with the gravel work pads in April, method # 1 (Shasta County's preferred method as described in the project BA) shall be used in constructing the gravel work pads. This method is as follows:

      Between August 15 and September 15, anti-spawning mats shall be installed in the expected footprints of the future gravel work pads. The mats shall remain in place for at least 60 days, after which time they shall be removed and immediately replaced with clean gravel fill.

   b. Gravel size will be between 1 and 4 inches in diameter, and will be uncrushed, rounded natural river rock with no sharp edges.

   c. In order to supply clean gravel to downstream spawning habitat, the gravel work pads shall not be fully removed following their use. Instead, only non-gravel surfacing materials and any other materials which are required to be removed by the California Reclamation Board to avoid flood risk shall be removed. The remaining spawning gravel shall be left in the river channel and allowed to wash downstream and be distributed naturally by high stream flows.

3. FHWA/Caltrans shall provide a yearly report summarizing construction activities, species status within 200 yards upstream and downstream of the bridge site, avoidance and/or minimization measures taken, and any observed take incidents.

   a. FHWA/Caltrans shall provide a summary report by December 31 of each construction year detailing in-water construction activities and the results of acoustic monitoring.

   b. If a listed species is observed injured or killed by project activities, FHWA/Caltrans shall contact NMFS within 48 hours at 650 Capitol Mall, Suite 8-300, Sacramento, CA 95815. Notification shall include species identification, the number of fish, and a description of the action that resulted in take. If possible, dead individuals shall be collected, placed in an airtight bag, and refrigerated with the aforementioned information until further direction is received from NMFS.

Updates and reports required by these terms and conditions shall be submitted to:

Supervisor
Sacramento Area Office
National Marine Fisheries Service
650 Capitol Mall, Suite 8-300
Sacramento CA 95814
FAX: (916) 930-3629
Phone: (916) 930-3600

X. CONSERVATION RECOMMENDATION

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. These conservation recommendations include discretionary measures that the FHWA and Caltrans can take to minimize or avoid adverse effects of a proposed action on a listed species or critical habitat or regarding the development of information. In addition to the terms and conditions of the Incidental Take Statement, NMFS provides the following conservation recommendations that would reduce or avoid adverse impacts on the listed species:

FHWA and Caltrans should utilize the results of the acoustic studies to evaluate the effects of pile driving on salmonids in order to develop site-specific avoidance and minimization measures for future bridge projects.

XI. REINITIATION OF CONSULTATION

This concludes formal consultation on the proposed Airport Road Bridge Replacement project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required if (1) the amount or extent of taking specified in any incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the action is subsequently modified in a manner that causes an effect to the listed species that was not considered in the biological opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

This concludes formal conferencing on the proposed Airport Road Bridge Replacement project. You may ask NMFS to confirm the conference opinion as a biological opinion issued through formal consultation if the southern DPS of North American green sturgeon is listed as threatened. The request must be in writing. If NMFS reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, NMFS will confirm the conference opinion as the biological opinion for the project and no further section 7 consultation will be necessary.

XIII. LITERATURE CITED

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Enclosure 2

<u>Magnuson-Stevens Fishery Conservation and Management Act (MSA)</u>

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS[1]
Federal Highway Administration (FHA) Airport Road Bridge Replacement project

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

The geographic extent of freshwater essential fish habitat (EFH) for the Pacific salmon fishery includes waters currently or historically accessible to salmon within specific U.S. Geological Survey hydrologic units (Pacific Fishery Management Council 1999). For the Sacramento River watershed, the aquatic areas identified as EFH for Chinook salmon are within the hydrologic unit map numbered 18020109 (lower Sacramento River) and 18020112 (upper Sacramento River to Clear Creek). The upstream extent of Pacific salmon EFH in the Sacramento River is to Keswick Dam at river mile (RM) 269.5.

EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of EFH, "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

The associated biological opinion thoroughly addresses the species of Chinook salmon listed both under the Endangered Species Act (ESA) as well as the MSA which will potentially be affected by the proposed action, which are the Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) and the Sacramento River winter-run Chinook salmon (*O. tshawytscha*). Therefore, this EFH consultation will concentrate primarily on the Central Valley fall/late fall-run Chinook salmon (*O. tshawytscha*) which is covered under the MSA although not listed under the ESA.

The Sacramento, Feather, Yuba, American, Cosumnes, Mokelumne, Stanislaus, Tuolumne, Merced, and San Joaquin Rivers, and many of their tributaries, support wild populations of Central Valley fall-/late fall-run (herein "fall-run") Chinook salmon. However, 40 to 50 percent of spawning and rearing habitats once used by these fish have been lost or degraded. Fall-run Chinook salmon were once found throughout the Sacramento and San Joaquin River drainages, but have suffered declines since the mid-1900s as a result of several factors, including commercial fishing, blockage of spawning and rearing habitat, water flow fluctuations,

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[1] The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) set forth new mandates for NOAA's National Marine Fisheries Service (NMFS) and Federal action agencies to protect important marine and anadromous fish habitat. Federal action agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with NMFS regarding potential adverse effects of their actions on EFH, and respond in writing to NMFS "EFH Conservation Recommendations." The Pacific Fisheries Management Council has identified essential fish habitat (EFH) for the Pacific salmon fishery in Amendment 14 to the Pacific Coast Salmon Fishery Management Plan.

unsuitable water temperatures, loss of fish in overflow basins, loss of genetic fitness and habitat competition due to straying hatchery fish, and a reduction in habitat quality.

All Chinook salmon in the Sacramento/San Joaquin basin are genetically and physically distinguishable from coastal forms (Clark 1929). In general, San Joaquin River populations tend to mature at an earlier age and spawn later in the year than Sacramento River populations. These differences could have been phenotypic responses to the generally warmer temperature and lower flow conditions found in the San Joaquin River Basin relative to the Sacramento River Basin. There is no apparent difference in the distribution of marine coded wire tag (CWT) recoveries from Sacramento and San Joaquin River hatchery populations, nor are there genetic differences between Sacramento and San Joaquin River fall-run populations (based on DNA and allozyme analysis) of a similar magnitude to that used in distinguishing other ESUs. This apparent lack of distinguishing life-history and genetic characteristics may be due, in part, to large-scale transfers of Sacramento River fall-run Chinook salmon into the San Joaquin River Basin.

The historical abundance of fall- and late-fall run Chinook salmon is poorly documented (Myers *et al.* 1998) and complete estimates are not available until 1953 (USFWS 1995). From the late 1930s to the late 1950s estimates for mainstem Sacramento River fall-run were obtained from spawning surveys and ladder counts at the Anderson-Cottonwood Irrigation Dam. Although surveys were not consistent or complete, they did yield population estimates for Sacramento River fall-run ranging from 102,000 to 513,000 fish (Yoshiyama et al. 1998). Average escapement from the 1953 to 1966 was 179,000 fish and from 1967 to 1991 was 77,000 (USFWS 1995). From 1992 to 1997 the estimated Sacramento River fall-run population has ranged from 107,300 to 381,000 fish (Yoshiyama *et al.* 1998). Over the last 5 years average escapement of naturally produced fall-run has been above 190,000; however 20-40 percent of these natural spawners have been of hatchery origin. The increase in salmon runs in the Sacramento River since 1990 may be attributable to several factors including, increased water supplies following the 1987-1992 drought, stricter ocean harvest regulations, and fisheries restoration actions throughout the Central Valley. However, it is unclear if natural populations are self-sustaining or if the appearance of a healthy population is due to high hatchery production. Concern remains over impacts from high hatchery production and harvest levels, although ocean and freshwater harvest rates have been recently reduced.

A. Life History and Habitat Requirements

Central Valley fall-run Chinook are "ocean-type", entering the Sacramento River from July through December, and spawning from October through January. Peak spawning occurs in October and November (Reynolds *et al.* 1993). Chinook salmon spawning generally occurs in swift, relatively shallow riffles or along the edges of fast runs at depths up to15 feet. Preferred spawning substrate is clean loose gravel. Gravels are unsuitable for spawning when cemented with clay or fines, or when sediments settle out onto redds reducing intergravel percolation (NMFS 1997).

Egg incubation occurs from October through March, and juvenile rearing and smolt emigration occurs from January through June (Reynolds *et al.* 1993). Shortly after emergence from their gravel nests, most fry disperse downstream towards the Delta and estuary (Kjelson *et al.* 1982). The remainder of fry hides in the gravel or station in calm, shallow waters with bank cover such as tree roots, logs, and submerged or overhead vegetation. These juveniles feed and grow from January through mid-May, and emigrate to the Delta and estuary from mid-March through mid-June (Lister and Genoe 1970). As they grow, the juveniles associate with coarser substrates along the stream margin or farther from shore (Healey 1991). Along the emigration route, tributary streams are used as rearing habitat. These non-natal rearing areas are highly productive micro-habitats providing abundant food and cover for juvenile Chinook salmon to grow to the smolt stage. Smolts are juvenile salmonids that are undergoing a physiological transformation that allows them to enter saltwater. These smolts generally spend a very short time in the Delta and estuary before entry into the ocean.

In contrast, the majority of fry carried downstream soon after emergence is believed to reside in the Delta and estuary for several months before entering the ocean (Healey 1980, 1982; Kjelson *et al.* 1982). Principal foods of Chinook salmon while rearing in freshwater and estuarine environments are larval and adult insects and zooplankton such as *Daphnia,* flies, gnats, mosquitoes or copepods (Kjelson *et al.* 1982), stonefly nymphs or beetle larvae (Chapman and Quistdorff 1938) as well as other estuarine and freshwater invertebrates. All outmigrant Central Valley fall-run Chinook salmon depend on passage through the Sacramento-San Joaquin Delta for access to the ocean. They remain off the California coast during their ocean residence and migration.

II. PROPOSED ACTION

The proposed action is described in the *Description of the Proposed Action* section of the associated biological opinion (Enclosure 1) for the threatened Central Valley steelhead, Central Valley spring-run Chinook salmon, and endangered Sacramento River winter-run Chinook salmon ESUs.

III. EFFECTS OF THE PROPOSED ACTION

NMFS finds that the project proponent will take steps to avoid impacts to spring- and winter-run Chinook salmon EFH by prohibiting any percussive work (pile driving and bridge demolition) during the primary spring- and winter-run Chinook salmon spawning period (April 15 through October 15). However, adverse effects to fall-run Chinook salmon spawning habitat and redds are expected to occur, as percussive work will be scheduled during the primary fall-run Chinook salmon spawning period (October through January). Engineering analysis described in the associated biological opinion indicate that driving small piles is likely to kill pre-eyed salmon eggs for up to 150 feet from the pile, and large "H" pile driving is likely to kill pre-eyed eggs for up to 450 feet away from the pile. Therefore it can be assumed that all fall-run Chinook salmon eggs laid within 19 days of pile driving activities and within a 900 foot radius of driven H-piles will be killed by acoustic pressure waves.

Project cofferdams will temporarily occupy EFH. Some juvenile Chinook salmon may be entrained into cofferdams when they are closed. Those fish which are entrained within these cofferdams would have a high probability (>90 percent) of survival due to planed fish salvage efforts. Pile driving, gravel approach pad installation, and demolition of the existing bridge are likely to harass adult and juvenile Chinook salmon.

Effects to EFH stemming from construction activities that may contribute sediment and increase turbidity will be further avoided or minimized by meeting Regional Board water quality objectives, Caltrans water pollution specifications, implementing applicable BMPs, staging equipment outside of the riparian corridor, limiting the amount of riparian vegetation removal, and replacing lost riparian vegetation at the project site or at the Battle Creek mitigation site.

EFH will be adversely affected by the disturbance of up to 1.2 acres of riparian vegetation and SRA habitat as a result of construction activities as well as temporary occupation of the riverbed and water column by cofferdams, work trestles and gravel work pads. The majority of these impacts are expected to be temporary, as all disturbed areas outside the actual footprint of the new bridge would be replanted with native riparian vegetation or restored to the natural riverine habitat conditions. Additionally, implementation of the proposed project would result in a permanent net increase of riverine habitat since this project would result in fewer piers being located within the floodplain.

The temporary impacts to riparian vegetation at the project site are expected to last for approximately ten to 20 years. Revegetating the project site along with any additional offsite mitigation that is necessary will quickly offset the adverse effects of removing annual plants; however, habitat attributes related to the replacement of large woody vegetation will not be realized for much longer. Construction of the gravel work pads will affect EFH by covering and altering the hydrology of suitable spawning habitat for two years, but the remaining gravel will ultimately improve spawning within the action area following the construction period as gravel which is left in the river is redistributed and made available to spawning fish.

These effects to EFH may result in a temporary redistribution of some individuals, primarily spawning adult, and rearing juvenile Chinook salmon, but, due to the temporary nature of these effects, and the long-term improvement expected from revegetating the project site and increasing the amount of spawning gravel in the action area, the adverse effects that are anticipated to result from the proposed project are not of the type, duration, or magnitude that would be expected to adversely modify EFH to the extent that it could lead to an appreciable reduction in the function and conservation role of the affected habitat. NMFS expects that nearly all of the adverse effects to EFH from this project will be of a short term nature (aside from some longer-term effects on woody riparian vegetation) and will not affect future generations of listed fish beyond the construction period of the project (two years).

IV. CONCLUSION

Upon review of the effects of FHA's Airport Road Bridge Replacement project, NMFS believes that the construction and operation of the project features may adversely affect EFH of Pacific salmon protected under MSA.

V. EFH CONSERVATION RECOMMENDATIONS

As the habitat requirements of Central Valley fall-run Chinook salmon within the action area are similar to those of the federally listed species addressed in the attached biological opinion, NMFS recommends that reasonable and prudent measures numbers 1 and 2 and their respective implementing terms and conditions listed in the incidental take statement prepared for Sacramento River winter-run Chinook salmon and Central Valley spring-run Chinook salmon in the associated biological opinion, be adopted as EFH conservation recommendations. Those terms and conditions which require the submittal of reports and status updates can be disregarded for the purposes of this EFH consultation as there is no need to duplicate those submittals.

VI. ACTION AGENCY STATUTORY REQUIREMENTS

Section 305(b)(4)(B) of the Magnuson-Stevens Act and Federal regulations (50 CFR § 600.920) to implement the EFH provisions of the Magnuson-Stevens Act require Federal action agencies to provide a detailed written response to NMFS, within 30 days of its receipt, responding to the EFH Conservation Recommendations. The response must include a description of measures adopted by the Agency for avoiding, mitigating, or offsetting the impact of the project on Pacific salmon EFH. In the case of a response that is inconsistent with NMFS' recommendations, the Agency must explain their reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(j)).

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